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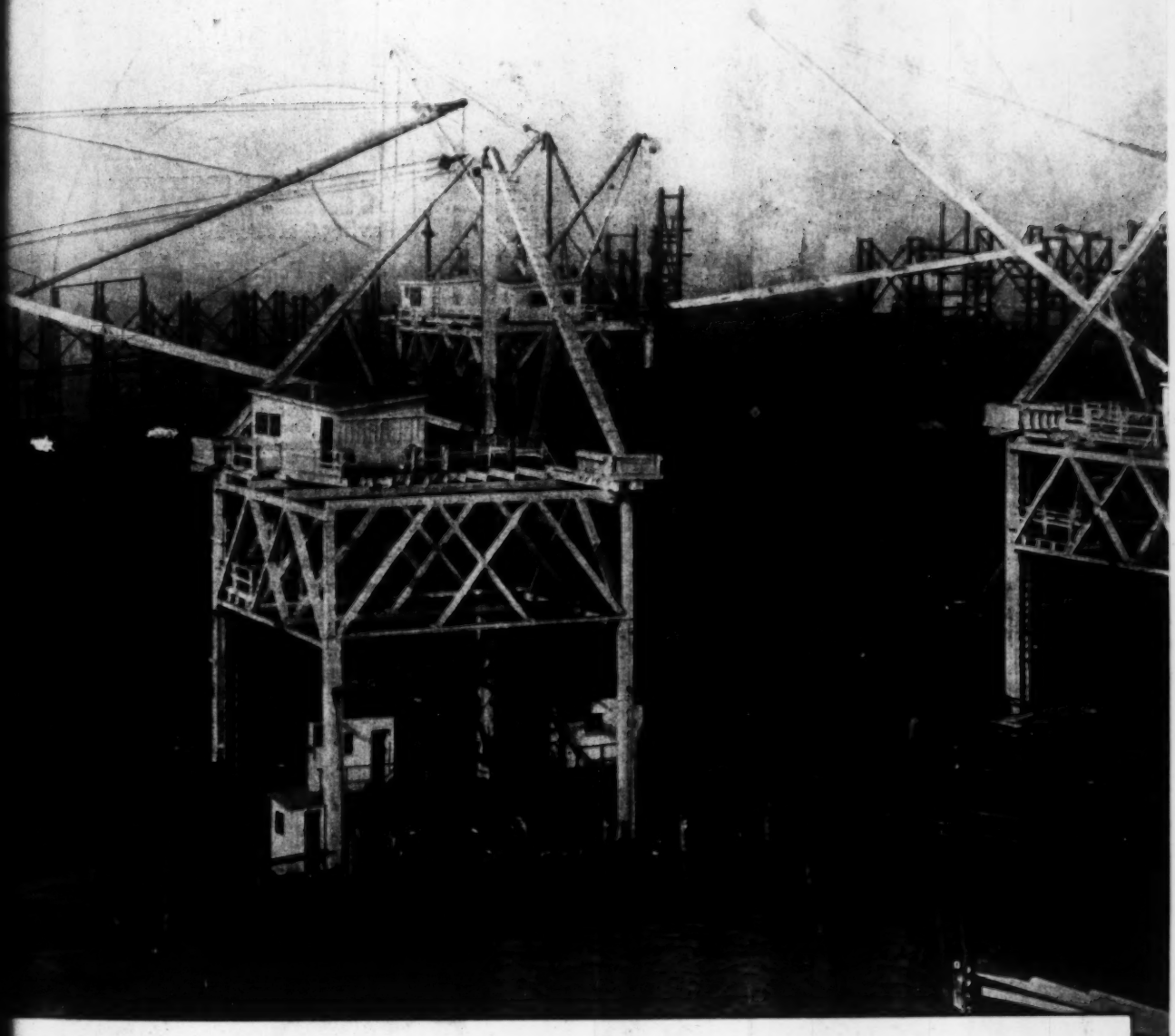

Effects of Overheating on Rivet Steel
By Prof. S. H. Graf

Concrete Barge Building in Four Yards

System Solves Highway Materials Supply
By Walter J. Driscoll

Moore Shipyard at San Francisco Uses Derrick Towers for Berth Service

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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Taking the Gamble Out of Garbage Disposal Contracts

BALTIMORE is not only to become the largest American city to have its garbage disposed of by feeding to hogs, but it has also made a step forward in taking the gamble out of garbage-disposal contracts. In the first place, the contract is for disposal only, thus eliminating the manifold collection risks. Then, and of great significance, the price which the contractor pays the city for the garbage is based on the selling price of live hogs in Chicago—and it is into live hogs that the contractor is to turn the garbage. This is a long step in advance.

No Engineer in Evidence

BUSINESS stands excused in large measure for subordinating the engineer, because of the engineer's own indifference to business affairs which affect his interests. Over 400 business men and public officials met last week in Chicago to combat a proposal by the Railroad Administration to increase freight rates on sand, gravel, crushed stone, and slag. This proposed increase in freight charges, as is pointed out on p. 306 and as was discussed editorially in *Engineering News-Record* of Jan. 30, p. 213, means a material curtailment of public work and an enormous additional burden of expense for work which must be carried through. State legislatures sent delegates to protest against the proposed action; public-works officials, commercial and industrial organizations an individual manufacturers came forward with statistics and argument to demonstrate that the action was unwise. There was not a speaker who represented the engineering profession, nor one who represented the contracting business.

Direct Locations for Trunk Highways

FEDERAL and state highway officials are already studying proper locations for through highway routes, and more of them will be doing so if the expected boom in highway building materializes. Heretofore it has been the custom to select a route with the idea of touching all the principal centers of population along the line, often at considerable increase in distance. With the increasing evidence that these routes will become parts of a connected freight-transportation system, it is a question whether one of the controlling economic factors will not be the shortest distance between the most important centers of population, as suggested by our correspondent on p. 299. No doubt, selection on this principle would, in the initial stages, cause a great amount of complaint from those not living on the main route, and from politicians who wished to use the roads as political capital to influence the voters in their districts. But such opposition subsides when the cities off the direct route realize the advantage of having the wear and congestion of through traffic removed from their streets. The State of Delaware has adopted this principle of location with excellent results, and with satisfaction to the public. We are on the eve of a tremendous development of the highways for freight transportation. Broad vision divorced from property and political interests will be necessary if these highways are to be located to the best advantage.

A Treaty to Develop the Port of New York

A TREATY between the States of New York and New Jersey is to be introduced in the legislatures of both states and, if adopted, will establish a "port authority" which will have jurisdiction over the entire port district at New York City included within the two states. The treaty has been framed by the New York-New Jersey Port and Harbor Development Commission, an interstate body created by the legislatures of the two states two years ago with authority to study the needs of the entire port and prepare plans for its further development. The commission has found what has been evident to many engineers and others who have studied the needs for transportation, sanitation and other necessities of this great center of population at the mouth of the Hudson, that the first essential for successfully treating these problems is that the needs of the district shall be considered as a whole without regard to the state boundary which bisects it. Few outside the engineering profession realize how frequently the development of great public works is hampered by the conflicting jurisdiction on different sides of state boundaries. But the Palisades Interstate Park Commission of New York and New Jersey has acquired and developed lands representing a value of some $9,000,000. If these two states can now establish a single authority for the entire port of New York, they will provide a further precedent of great value in encouraging similar joint state action by other commonwealths.

British National Aid To Highway Building

NATIONAL aid in road-building to the extent of £10,000,000 has been granted for 1919-20 through the Road Board to local authorities in England. This means the resumption of the help which was given annually for some years prior to the war. The action was

taken on account of "the desirability of stimulating employment on useful work at the present time," which is one of the leading arguments for an immediate increase in Federal-aid road work in the United States. Highway officials here who have watched their roads go to pieces under war-time trucking will find some comfort in the fact that the British national aid is to be used, so far as possible, on the important roads and bridges where heavy trucking is probable or has taken place during the war. This aid will not be granted to a local authority unless it agrees to carry on as extensive a road program as was finished in the year immediately preceding the war. The significant thing about this action, to American engineers, is the official recognition given in the first post-war road announcement to the fact that roads must be built for the traffic, and traffic should not be regulated to fit antiquated roads. Of course, it is ridiculous to allow one or two heavy vehicles to ruin a road fit for all other travel which uses it; but where motor trucks are useful it is sound economy to build roads for them and not force the people to pay needlessly high transportation charges, by severely restrictive traffic regulations. The war has brought motor trucking to the front, and with it the same sort of new problems which arose when motor cars came into use. The British authorities, conservative as they were in changing their road methods to fit the automobile, have shown no sign of conservatism in the new situation that faces them. But what are we doing?

Judgment and Calculation in Fixing Working Stresses

WORKING stresses for use in the design of engineering structures require to be fixed by means of technical judgment of remarkably high type. Many factors are involved, relating to present and future service as well as to quality of material; and few of them are amenable to calculation. It is therefore not possible to apply precise methods to the determination of these stress values; judgment must be the chief reliance in evaluating the factors of influence. Yet attempts are frequently made to fix working stresses by a process of calculation. Several such attempts are engaging attention just now, and it is of value to consider them, as an understanding of their nature will tend to prevent misconceptions of the meaning of their results.

Three different methods of calculation have come to light as having been used in arriving at allowable working loads on steel columns. Their results, curiously enough, are identical, though the starting points and the methods of procedure employed differed considerably.

According to the report of the American Society of Civil Engineers' Committee on Steel Columns and Struts, now discharged, the committee fixed the loading which it recommended as the limit of safety by comparison with tensile-stress practice. It considered that both in tension and in compression 50% of the elastic-failure load might be used as working load with safety, this view agreeing with ordinary practice as to tension members. The committee then reported that its tests showed the elastic limit (or "useful limit") of columns to be 24,000 lb. This value of 24,000 was reached by a unique process; it is the average value determined from a large number of tests, in turn averaged with the lowest single value of all those obtained. Evidently the committee believed that the figure of 24,000 lb. per square inch thus found represents a strength that may with reasonable certainty be counted on under all conditions. The manifold influences that separately affect column resistance were not considered in detail, but these effects were pooled in the committee's judgment as described, and the line of safety was, so to say, put at the edge of the middle third.

A different explanation of the 12,000-lb. column-load limitation has been given by an engineer of note who formerly belonged to the committee. His view is that 40,000 lb. may be accepted as the ultimate limit of tensile value, characterized by elastic failure of the steel; and that 30,000 lb. is to be taken as the limit of column strength, a value maintained with fair reliability throughout a large range of conditions. The same proportion of both, then, should be taken as safe working load. Since the commonly used tensile stress of 16,000 lb. is 40% of the tensile value, the limit of column load is to be fixed at 40% of 30,000, or 12,000 lb. per sq.in.

Rather higher factors of safety were adopted by a committee of Canadian engineers in devising a new column formula, embodied in recently published bridge specifications of the Engineering Institute of Canada. This committee determined one-third the average strengths of various groups of test columns, using the same tests studied by the American committee. This value of one-third was taken to be coördinate with a stress of one-third the ultimate strength for riveted tension members. Again the basal figure for column loading was found to be 12,000.

It is hardly possible to contemplate these different procedures, all yielding the same result, and feel any great confidence in the merit of the calculations. In fact, the conclusion cannot be escaped that the three calculations are nothing other than methods of judgment, whose thin veneer of figures has little meaning. Whatever virtue resides in the recommended working stresses, then, is due to the excellence of judgment of the men who offer them, and not to the excellence of the analysis presented.

The use of calculation in fixing stress limits, where the real decision is made by judgment, is harmless when the true state of affairs is appreciated. It may easily have a misleading effect, on the other hand, when the calculation is regarded as producing exact results.

There is a tendency, moreover, to regard working stresses, and, for that matter, specifications, as laying down boundary lines between safety and danger. This is apt to prove a particularly harmful view when working stresses backed apparently by mathematical deduction are expressly stated to be limits of safe loading. The fact is, of course, that no stress limits afford complete protection againt unsafe design; yet this truth is often forgotten when the question of working stresses is approached from the standpoint of safety. The controlling consideration with regard to all broad rules of design practice is the proper utilization of the material,

a matter demanding quite as much care to avoid waste of material as to avoid overstress. This is preëminently a field for the exercise of judgment, and the appearance of calculation applied to the subject tends to interfere with successful use of judgment rather than to promote it.

Are You Doing Your Share To Start Construction?

CALAMITY howlers are never popular. The world loves a cheerful optimist. But there are times when a considered pessimism is necessary, because it demands a looking forward and a seeking for remedies which never enter into the program of those who hold that everything is well in this best of all possible worlds. Today construction work is in so low a state as to demand an active pessimism that can be translated into the kind of results which optimism only passively hopes for.

Six months or a year ahead of us lies a period of unprecedented industrial activity. This must be so. A world starved for four years of everything but bare necessities must be fed, clothed and amused by producers made measurably fewer by the ravages of war. Plants and utilities and structures left for years to take care of themselves must be restored to an economical working basis. Normal increase in producing capacity must be regained. Construction, next to agriculture the basic industry, will absorb growing numbers of men and quantities of material and vitalize all industrial life.

Meanwhile, there is today a dearth of construction work. In spite of certain widely circulated reports of unprecedented activity in all kinds of building—reports based on a kind of whistling courage—every contractor and engineer knows that never before in the memory of the present generation has a February come with so little actual business in prospect or on the books. In consequence this reservoir to provide against unemployment and to restore confidence—for agriculture will not begin to absorb labor for some months—is empty and shows no signs of immediate filling. And soldiers and munition workers are coming back toward industry by the millions.

Why is construction holding off? Because it costs so much? No; because it is hoped that six months from now it will be cheaper. Because no man wants to spend $2 today for that which he expects to be able to buy for $1 tomorrow. Millions of dollars of work would start immediately if there were assurance that the cost of such work would be the same next year or even next summer. We are in a condition where individual timidity is outweighing mass confidence. Every prospective builder, be he the president or director of a railway, the mayor of a city or the owner of an industrial plant, is drawing into his own shell of self-protection and betting on his own personal preservation in the general cataclysm of panic which is bound to follow continued inactivity. Everyone is counting on not being the hindmost in the devil's drive which he hopes against his better judgment will not come.

One of the most misunderstood laws in the world is that of supply and demand. How often is it quoted as inevitable! How often is it forgotten that the essence of inevitability is time! Demand controls supply—but not immediately, and in the intervening days, or months, or years can happen all sorts of things that confuse the law and serve to destroy or impair its natural results. Everyone is sitting back and waiting for the obvious demand of the world's needs to adjust the elements of his part of its supply to his liking or to his expectancy.

What is going to be done about it? The necessity in the case of public works is obvious. In spite of costs or prices, it is the solemn duty of every public agency to start immediately all of the necessary construction activities which have been delayed for the past year or two. What if the cost is greater; charge it up to insurance. Unless economics and common sense and statistics are all equally wrong, we are fast approaching a period of unemployment with accompanying social distress far more expensive to the body politic than any possible increase in cost of construction due to present conditions. Let those bright optimists of the do-nothing type take what comfort they can from their self-satisfaction. The world is in ferment. He who runs may read.

The obligation is just as great on all of the private interests that go to make up a piece of finished construction. Personal selfishness must be forgotten now just as it was in the nineteen months of war. Every element—the owner, the contractor, the material man and the laborer—must be prepared to give up something. As it stands today, no one will concede anything. The material man wants his full price, labor wants its war-time wage, capital must be assured of its full investment profit.

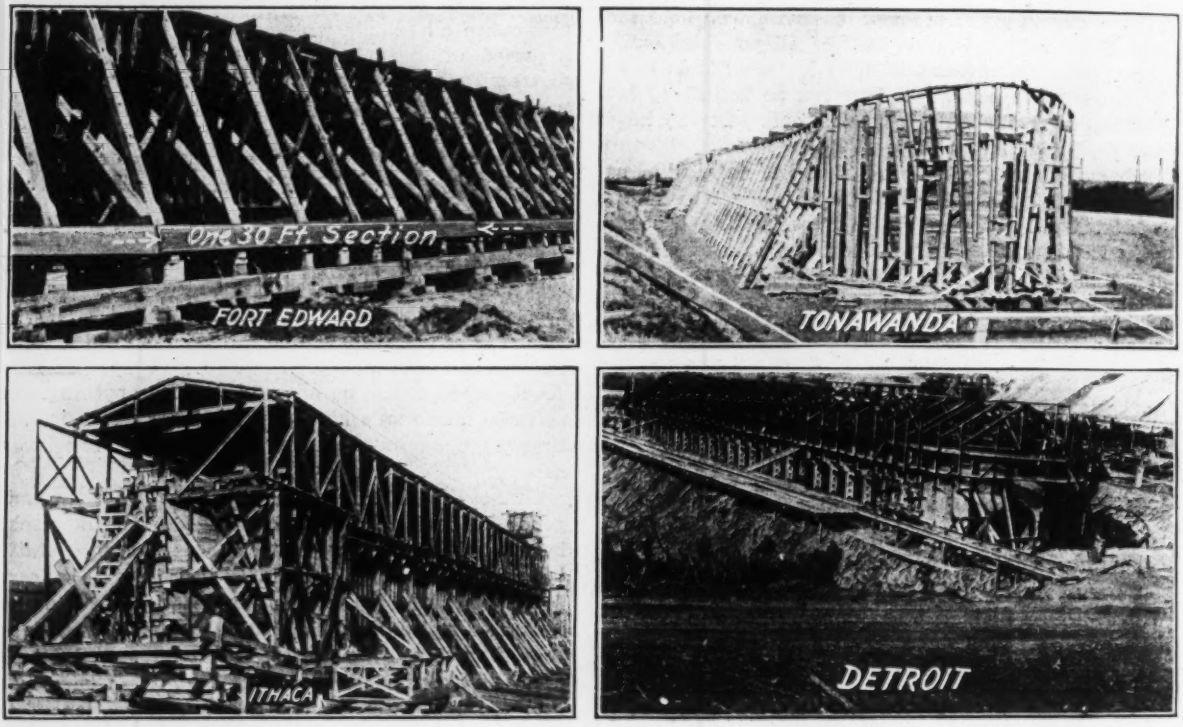
Cannot a scientific method of preparing for the emergency be devised? Cannot an agreement be reached between the various parties to a construction operation whereby future adjustments in prices will be cared for? The fear of a lowering of prices after the work is started and paid for is holding up more construction than fear of the high prices themselves. Why cannot every new construction contract be written on a delivery basis? It would be merely a modification of the Construction Division's form of contract, by virtue of which the owner would pick a responsible contractor at a graduated but limited fee and then pay for his labor and material at the price they commanded when used. The contractor wants work to keep his organization intact; he should be willing to make some sacrifice in his normal profit. The material man must dispose of his stock if he expects to keep in business; cannot he contribute something in the way of reduced prices? Labor must live; may its contribution not be an efficient performance which all employers say will alone make possible the high wages demanded to meet increased living costs? The owner gets an approximation of full future value in the adjusted costs, and the difference is what he pays toward the common good.

This is a time for coöperation based on a lively sense of impending common danger. Optimism for the future is justified to the extent that prompt present action is taken. Ahead of us lies a wonderful and growing prosperity. Must we pass through a slough of depression for lack of united action and individual sacrifice? Did patriotism go out of business on Nov. 11?

How the New York Canal Concrete Barge Is Being Built

In Four Yards Independently at Work on Same Type of Boat Differences May Be noted in Yard Layout, Launching Schemes, Form Construction and Steel Placing

EXCEPTIONAL opportunity to study methods of concrete-boat construction is afforded by the simultaneous building in four different yards of the 500-ton barge designed by the Emergency Fleet Corporation for the Railroad Administration, and to be used on the New York State Barge Canal. While the general operation in building these barges is supervised by the engineers of the Concrete Ship Section of the Fleet for four to be built alongside of the Ellicott Creek canal at Tonawanda, N. Y.; to the Cummings Structural Concrete Co., for four to be built on the inlet which makes in from the south end of Cayuga Lake at Ithaca, N. Y., and to Thomas E. Currie (the Grayhaven Shipbuilding Co.), for five to be built on the Detroit River, Detroit, Mich. Several boats have been completed at each of these yards, and all will be delivered to the



NEW YORK STATE CANAL CONCRETE BARGES UNDER CONSTRUCTION AT FOUR DIFFERENT YARDS

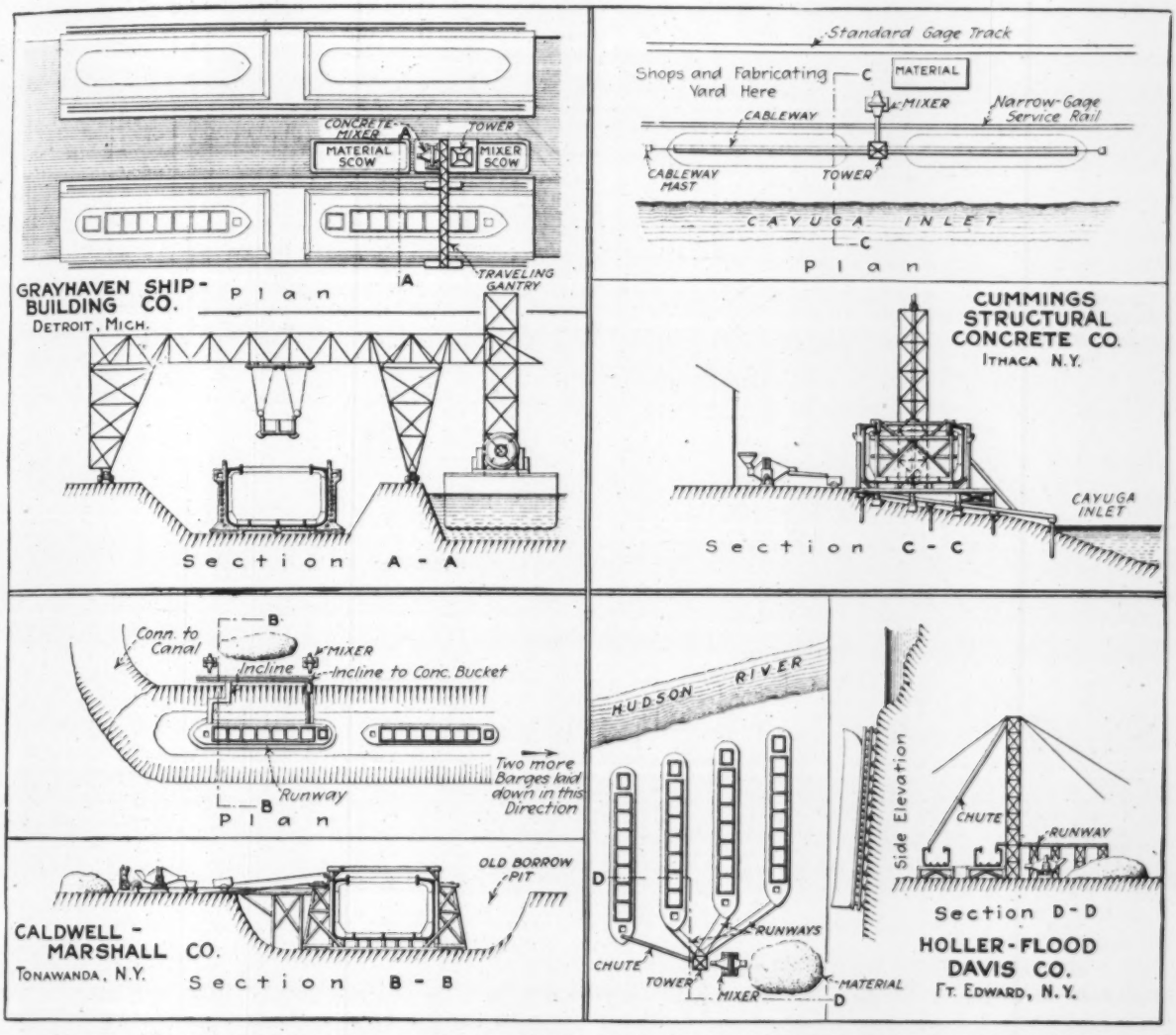
Corporation a free hand in plant layout and construction details is allowed the contractor. It happens that site conditions and individual initiative are so various in the four locations that many contrasting solutions of problems that are essentially the same are available.

The design of the New York State canal barge was described in *Engineering News-Record* of Aug. 8, 1918, p. 271. The boat is 150 ft. long, of 21-ft. beam, and 12 ft. deep. It is of the simplest open-box type, with frames 5 ft. on centers, a 3-in. shell, cantilevered side decks and an open hatchway crossed with deck beams every 15 ft. The bottom is flat except for a 2-ft. quadrant curve at the bilge. Contracts were let for 21 of these barges last summer, it being provided in the advertisement for bids that the barges be built at such locations that they could be towed to the New York canal system. Accordingly, the contracts were let to the Holler-Davis-Flood Co., for eight to be built at Fort Edward, N. Y., which is on the Hudson River some 60 miles north of Albany; to the Caldwell-Marshall Co., Railroad Administration in time for the opening of navigation on the canal next spring.

A primary difference is seen in the adoption by each of the four yards of a different system of launching, which reflects in the layout of the yard. A sketch of each of the four layouts is shown. At Detroit there is the remarkable dry-dock arrangement described in *Engineering News-Record* of Jan. 2, 1919, p. 21. In brief, this consists of four concrete-floored docks, two on each side of a lagoon leading into the Detroit River. The boats are built directly on these concrete floors in the dry; when they are completed the gates of the dock are opened, water is allowed to flow into the dock, and the boats are lifted from the base by hydraulic pumps and floated out into the lagoon. At Tonawanda advantage has been taken of a long borrow pit left in adjacent railroad construction. This pit is immediately alongside of the Ellicott Creek canal and separated therefrom by a narrow dike of earth. Each of the four barges contracted for here is provided with its own supports,

ranged in line along the borrow pit, as shown in the sketch, and launching is taken care of by a lock with about 4-ft. drop which lowers the barges into Ellicott Creek, a branch of the New York State Barge Canal, after they have been floated in the borrow pit. Provision is made for intermediate cross dikes so that the first barge completed, the one nearest the creek, can be floated out before the others are finished.

shop in the nearby city. The Detroit yard, on the other hand, is laid out for future shipwork of various sorts, and has full shop and mill equipment. At Fort Edward the contractor is also building wood barges, and has a large yard with self-sufficient shops and mills. The Ithaca yard, too, though designed for the present work, is well provided with shops and equipment. It is so located that one of the Barge Canal terminals can be



LAYOUT OF FOUR YARDS WHERE NEW YORK STATE CANAL 500-TON CONCRETE BARGE IS BEING BUILT

At Ithaca two side-launching ways are provided, dropping the barges into the inlet. Two barges will be built on each of the two ways. At Fort Edward there are four end-launching ways leading diagonally into the Hudson River. On each of the ways there will be built two of the barges contracted for. We have, therefore, two different types of float launching, an end-launching system, and a side-launching layout.

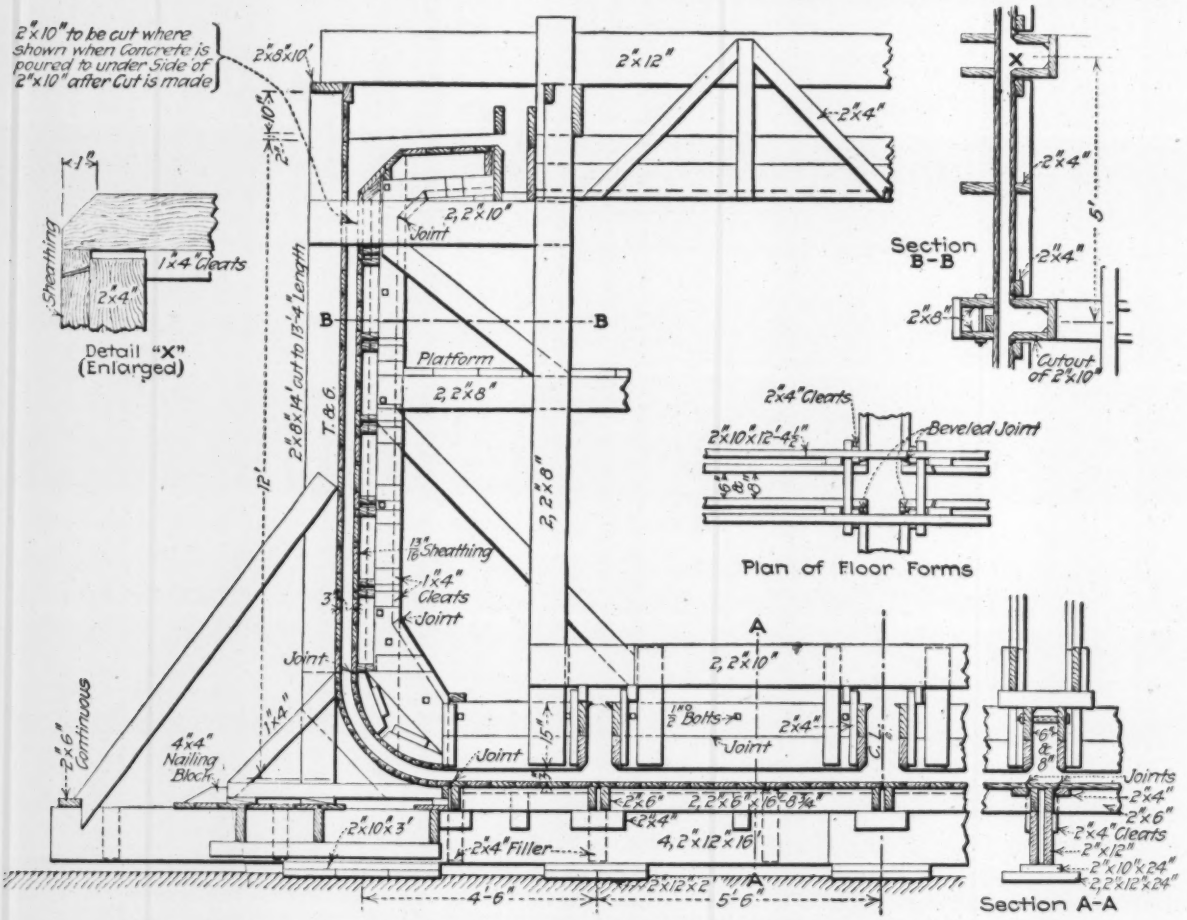
Yard equipment varies in the four yards. The Tonawanda plant is frankly temporary, laid out only for the four barges under contract. Its equipment is mobile and scanty. Carpenter work, both for forms and fitting out, is done, in so far as possible, by contract at a

utilized as a fitting-out dock, and the carpenter shop is placed alongside this dock.

The Government required that the barges be poured in one operation. This did not put any great burden on the concreting plant, because only about 120 yd. of concrete is involved, but it did make it necessary to set up a complete set of forms before any concreting was started. The yards, then, had the common problem of providing a complete form structure, comprising (1) supports or launching ways; (2) outside forms for the floor and for the shell—which latter included the warped surface forms for the bow and stern, and (3) inside forms for the frames and shell. These forms had to

be so arranged as to interfere as little as possible with the process of concreting, to be readily removable and re-usable, and to be of such design as to permit their removal clear of the barge when launched. In all cases, the barges were poured complete, the forms stripped for re-use in from one to two weeks, and the barge was launched in from two to four weeks after pouring commenced.

Supports or Launching Ways and Outside Forms—In all except the Detroit yard, where there is a concrete floor on which the barge is laid directly, the supports are timber frames on mudsills varying in design to suit the conditions of launching. In each case, the supporting frame extends far enough outside the barge itself to take the outside form posts and braces, when moved out away from the poured shell. On the supports rest the outside floor forms, so designed as to permit their ready removal.

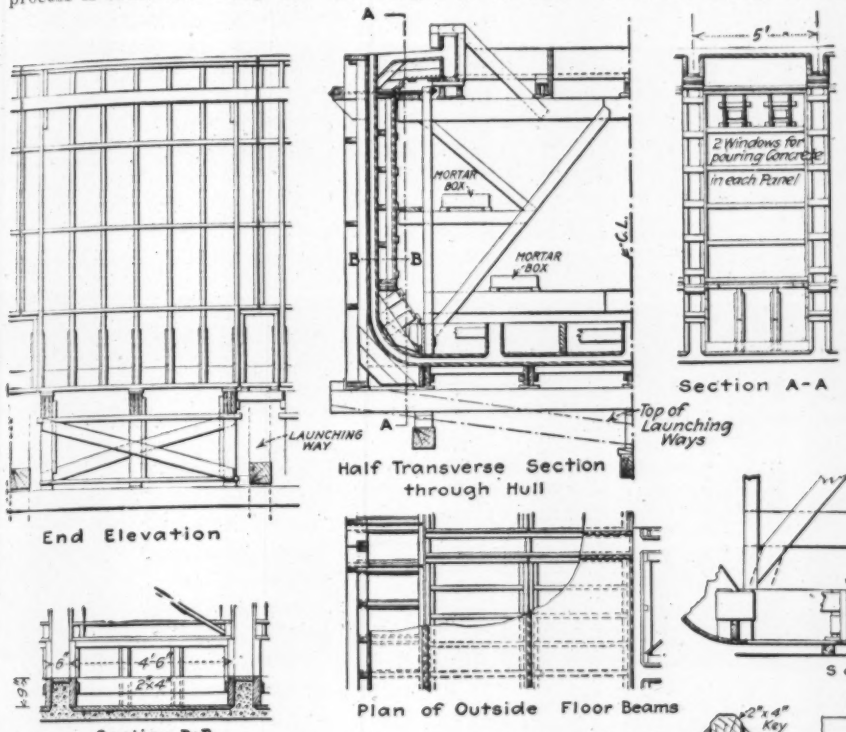


AT TONAWANDA, CALDWELL-MARSHALL CO. IS BUILDING CONCRETE BARGES ON STATIONARY SUPPORTS IN OLD BORROW PIT

In the Tonawanda yard, as shown in one of the drawings, longitudinal wooden sill footings reinforced with cross-beams on the ground carry transverse 2 x 12-in. planks under each of the frames extending to the floor. The bottom floor forms are in panels between the keelsons and the floor frames, and are held in place by cleats nailed to the transverse 2 x 12's. After the barge is complete these cleats are knocked out, and the bottom floor panels are dropped down and pulled out from under the boat, leaving 2 x 12's with the small piece under the frame. These latter are taken out piece by piece, and the boat is strutted up to the ground. The outside forms in the Tonawanda yard are in one piece, extending the whole straight length of the barge—that is, about 120 ft.; the tongue-and-groove lagging is carried on frames 5 ft. apart, as shown, which rest on wedges propped up from the ground. In stripping the forms these wedges are knocked out, thus dropping the whole outside form on its outward face and pulling it away from the concrete about 7 in. at the top. It can then be lifted out before launching by flotation takes place.

At Fort Edward an end-launching system is used, and longitudinal ways carry the whole boat during construction. The floor is supported, as shown in the drawing, on transverse 2 x 10's which are cantilevered out from the outside jack frames to meet at longitudinal stringers under the center keelson. There is one of these jack frames every 5 ft., and they are tied together in panels of 30 ft. The cantilevered floor-beams are bolted together when they meet at the center, to hold the whole floor in place during construction. The side frames which carry the lagging for the outside forms of the shell are propped up on wedges from above a transverse roller skid. When the boat is to be stripped the wedges are dropped from under the frames and floor, and

the whole frame in 30-ft. panels, with its cantilevered floor, is slid outward a sufficient distance to clear the outside launching way. The cradles are placed in this 30-ft. length, and the barge is supported on them. The process is continued along the whole length of the boat



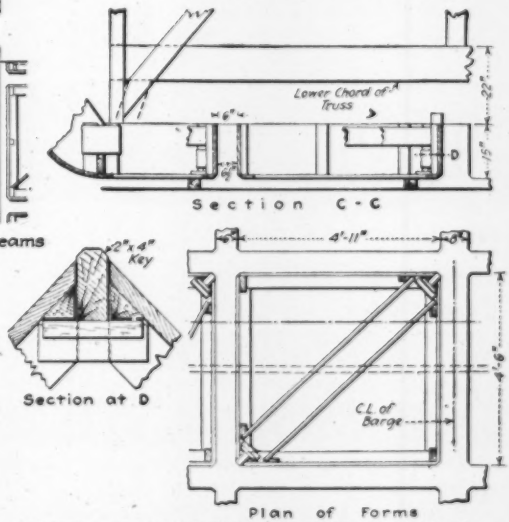
SIDE-LAUNCHING WAYS AT ITHACA

before it is ready for launching. The barge is built normal to the ways.

In the Ithaca yard the level floor of the main supports is strutted up from the sloping side-launching ways, and carries the bottom floor forms in panels of simple design. A separate drawing shows these forms in detail The panels are boxes with longitudinal stringers resting on wedges on the supports and carrying closely spaced transverse stringers on cleats. To dismantle, the wedges are drawn and the box is dropped. Outside shell forms are of different types for the shore and the water side. Because they have to be moved entirely out of the way before the barge is launched, the waterside outside forms were made in easily handled 10-ft. sections, with special panels at the bilge curve to permit the introduction of the launching cradles. In the first barge a similar design was used for the shore outside forms, because it was expected that the launching ways would extend shoreward of the forms, and provision was made to permit their placing. It was later decided that the ways need not extend so far, and the second set of shoreward forms was made in one piece for the whole straight length of the barge and was moved out bodily. The shore forms built for the first barge were used for waterside forms on the other way, and two sets of complete-length outside forms were made so that there were two full sets of forms available for the four barges.

In Detroit, as described in the previous article, the whole outside straight shell form is one piece backed against concrete frames, and is dropped by wedges and moved out bodily.

Inside Forms—There is a similarity in the design of the inside form framing in all of the yards, although there are differences in the method of taking care of the inside shell panels. In all the designs the inside forms are one structure, built up in its entirety before any concrete pouring is started. They consist of transverse timbers or trussed frames, every 5 ft. resting in the outside frames or studs and carrying by a dependent framework the floor-frame, side-frame and cantilever deck forms. Some of the designs intended that these forms should be at all times suspended from the upper truss work, but in construction the suspension was



INSIDE FLOOR FORMS AT CUMMINGS YARD

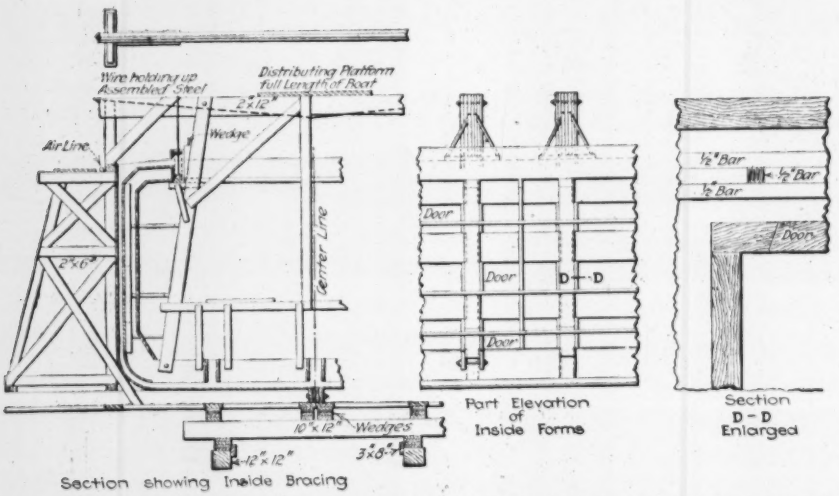
used merely as a stiffener, and the load of the forms was transferred by means of interposed concrete blocks, small pieces of stone, etc., to the floor steelwork, which in its turn was held a proper distance away from the bottom floor forms by similar pieces. The short cantilever deck was held everywhere by cross-frames extending out from the suspension structure and fastened also to the vertical frame forms, but at Fort Edward deck forms as well as the steel reinforcement were held in place by wires from the beams across the boat.

According to specifications, each yard had some overhead framework on which tarpaulins or planks, for cover in inclement weather, could be placed. At Ithaca the whole framework is enclosed and steam pipes within keep the temperature fit for concreting even when the outside temperature is very low.

The inside floor panels vary somewhat in detail, though in each design there is used a form box between the keelsons and the frame. At Detroit this box is built up with wood screws and in the stripping

it is taken apart by unscrewing the fastening. At Tonawanda the four corners of the boxes are cut on a beveled joint, and the box is held to the true square by overhead 2 x 4's used as spacers. In stripping, the 2 x 4's are knocked out and the boxes knocked apart on their beveled joints. At Ithaca the boxes have a special corner key, shown in one of the drawings. This is knocked out, and the form falls apart. The Fort Edward yard uses a hooked system of box forms in all of the demountable panels. In the floors, for instance, the four sides are connected with ordinary door hooks at the corners and are demounted by the knocking out of the hooks.

Inside Shell Forms—Shell frame forms in all cases are of heavy planks held in place by braces from the inside form framing and serving as guides for the shell forms. In Detroit part of the side planks were left permanently in place as the nailing strips for the barge lining. In these yards the face form of these frames was continuous, but at Fort Edward there were windows left in the form for the concrete, on account of the method of pouring.



AT FORT EDWARD, N. Y., HOLLER-DAVIS-FLOOD CO. BUILDS CONCRETE BARGES ON END-LAUNCHING WAYS

The inside shell forms have to be designed so as to permit openings up the side of the shell as the concrete is poured. It is manifestly impracticable to pour the 3-in. shell from the top, with assurance at the same time that the forms will be filled clear around the bottom of the bilge curve. In all cases, the bilge curve outer form is a part of the outside forms—a solid section tacked to curved studs attached to the jack frames—and the inner form is made up of lagging attached to a segmental form hung from the inner frame. This lagging is of narrow slats laid longitudinally.

In two of the yards, at Detroit and Tonawanda, the inside shell forms are in panels 2 ft. deep extending between the frame forms, and sliding against the bearing of these forms, as shown in the drawings. There is one less panel in the section between frames than is required to fill the full height, and in the beginning of the pouring the opening 2 ft. wide is left just above the top of the bilge curve. When the concrete reaches the top of the bilge curve the panel next above is dropped down flush with the top of the bilge curve, leaving the 2-ft. opening then in the next panel above. The process is continued until the entire shell is poured. The two drop-panel systems differ somewhat in detail, as shown in the drawings.

In the Ithaca yard the inside shell form is built in an integral panel extending the whole depth of the boat and the distance between frames. Small windows are then cut in the form at regular intervals, with an inside bevel on the joint. The wood window is then removed while the concrete is being poured, and as soon as the pouring reaches the bottom of the opening the gate is put back and buttoned tight against the standing part of the form. The sides of these forms are beveled, to permit their removal, but it proved to be difficult to take them out, even with this provision. At Fort Edward panels 2 ft. in depth and frame spacing in width are provided for the whole depth of the shell. These are buttoned on against one another, to resist the movement toward the outside of the boat, and held with door hooks to the studs, to resist an opposite movement. Panels are taken out one at a time as the concrete pouring rises in the shell.

Outside and inside shell forms are all tongue-and-groove material, but matched lumber is used for the inside for the warped surfaces.

Four different systems of outside end forms are used. Both bow and stern of the canal barge are curved, the stern having a warped curve for its full height, and the bow being warped only up to the top of the bilge line, above which the only curve is the one in the horizontal plane. Complications of these curves, however, forbid the continuation of the regular system of forms. In Detroit, mortar molds are used for both ends of the boat. These molds, as described in the previous article, are divided into three parts, and are slid out on the jack frames to be used over again in other boats. At Fort Edward an attempt was made to cover the curve studding with surfaced lagging and a tin form. This did not prove entirely satisfactory, because the tin was wrinkled by hickeys while placing steel and left a wrinkled surface on the concrete simulating too vividly the mold from which it was formed. At Ithaca narrow lagging was bent around the templet-formed studs, the slats being made of quarter-sawed cypress. Similar bending of slats was used at Tonawanda, but oiled elm was used for the lagging. In both these cases the fitting of the studs to the proper curve and the bending of the lagging made a nice piece of carpentry. Inside end forms in all cases were small boxes cut to the varying curves of the ship and fitted in between the frames.

Placing Steel—In all the boats, the floor steel was laid first and the side shell steel tacked into place on

the outside form, wired together, and then braced out from the outside form with small concrete spacers. At Ithaca, however, in the later boats, special clipped spacers with protruding hooks at proper locations for the longitudinal steel were attached against the side of the boat, and the longitudinal steel was dropped into these clips. The clips were allowed to remain in place. The strips against which they were nailed were removed when the forms were taken down, and the opening was

A—Oiled Elm Bent Around Frames at Tonawanda

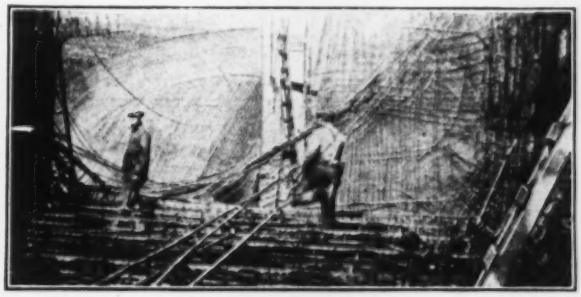
END FORMS DIFFERENT IN THREE YARDS

plastered up. In some of the boats, longitudinal rods were welded by spot welding. In others, they were overlapped and wired. In three of the boats, the steel frames were prefabricated, and lifted or carried into place in the boat. At Fort Edward the stirrups on the frames were electrically welded, but in the other yards they were wired. In the Tonawanda yard all the frame steel was erected and fabricated in place in the boat.

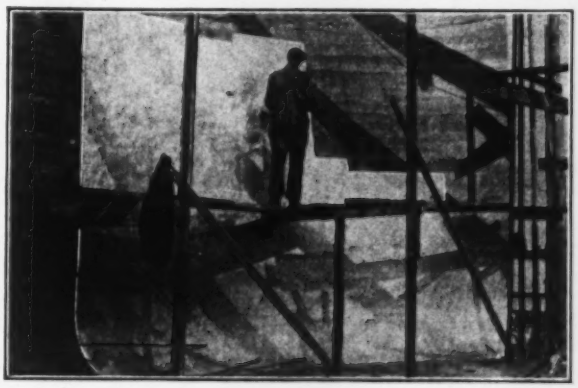
Concreting Plant—The problem in concreting one of these barges was not in producing the concrete, nor even in getting it to the boat. Both of these processes will, in general, be held up by the difficulty in placing concrete in the narrow forms, congested as they are with steel and difficult of approach through the forest of supporting framework. As described in the previous article, the Detroit yard has a special gantry crane, traveling over the boat, which drops the concrete, where required, from a bucket. All the other yards use a buggy wheeling system to get the concrete to the place of deposition, although in the first boat poured at Fort Edward a chuting system, shown in one of the sketches, was used. This did not prove satisfactory, and for further boats there were built from the concrete mixer trestles over which the buggies were wheeled to the boats themselves. At Ithaca the concrete mixer is located immediately alongside of the material pile between and just off line of the two ways. The material enters the yard by rail, is dumped alongside the mixer, feeds through the mixer into a car, which is pushed under the tower and elevated to runways extending out along the center line of the barge from the upper deck level to the tower.

At Tonawanda an extremely simple plant is used. Two concrete mixers under a canvas cover are moved along the bank of the borrow pit as required, the materials being dumped alongside of them as they move from boat to boat. The timber runway runs alongside the dump end of each mixer to an incline up to the platform along one side of the barges. The concrete is dumped into an ordinary concrete barrow and pulled up the incline with a line leading through a spool on the barge back to the mixer.

In every yard but Ithaca, where a center runway was used, there was a runway at deck level around the outside of the boat. All the boats had runways on the top of the floor frames, but in Detroit these were used only for the men themselves to work on, the concrete being chuted to the bottom from a runway half way up the frame, on which runway were mortar boxes receiving



C—Quarter-Sawed Cypress Matched on Frames at Ithaca



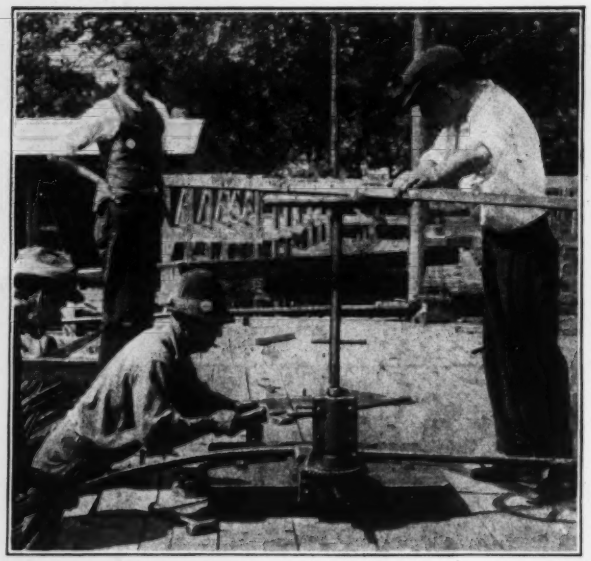
B—Tin Tacked on Lagging at Fort Edward

concrete direct from the gantry bucket. In the other boats, however, the buggies or boxes—and at Tonawanda mortar boxes on small industrial dollies—were kept on the bottom runway and were filled from chutes from the upper runway. The men then shoveled from the boxes into the floor and lower side forms. In all cases, as the shell concrete rose, the midway runway was used. These midway runways were all supported from the inside frames, except in the case of Fort Edward, where the midway platform was hung by bent reinforcing rods, improvised for the occasion, to the trusses across the boat. In all cases, one form or another of portable hopper, made up either of straight pieces of wood or of bent galvanized iron, was used to facilitate the pouring of the concrete into the side forms.

In general, the order of pouring was as follows: Bilge curve, floor frames, keelsons, floors, side shell and deck. The principle followed was to lead the concrete into the open, getting the benefit of the course of air flowing ahead of the concrete. Pouring began at the top of the bilge curve, and when the concrete began to tail out on the floor, it was reasonably certain that the curve was filled. Likewise, when the floor frames were poured, concrete tailed out onto the floor.

Following the general practice on the Emergency Fleet concrete ships, mechanical hammers were used to vibrate the sides of the forms and agitate the concrete so that it would run around the curves of the bilge and into the frames. At Detroit and Tonawanda electric hammers were used. In these cases, the whole inside framework of the boat was wired with plug outlets into which either hammer connections or electric-light connections could be placed. At Ithaca and Fort Edward compressed air was available, and air hammers were used. No difference in the effect of the two types has been noticeable.

At Fort Edward the keelsons and floor frames were



BENDING STEEL WITH BULLDOZER AT FORT EDWARD

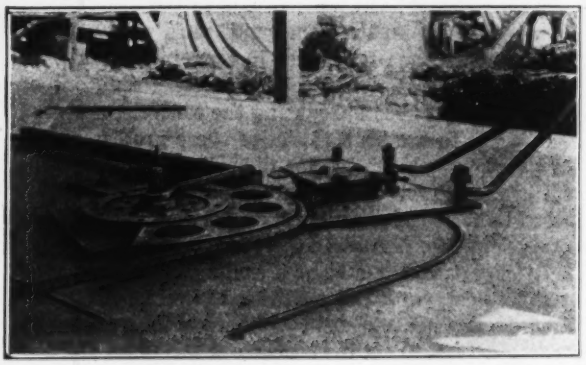
first poured, then the bilge curve, and then the side frames through the windows noted above. The contractor here felt that he could not be sure that the vertical side frames would be completely filled by pouring in the shell forms, as at the other yards.

Hand work predominates in handling the materials in all of the yards. At Detroit the transverse moving gantry is available, and floating derricks alongside can be used for heavy material, and are used in the placing of the transverse steel frames. At Ithaca two hand-operated cableways have been installed. These cableways operate between the central tower where the concrete mixer is, and two gin poles are set up at either end of the adjacent boats. The cable is continuous around the large spool at the base of the tower, up to the top of the tower, across over the boat, down to the bottom of the pole and under the boat and back to the spool. It is controlled by hand movement on the spool, and it carries an ordinary triplex block, also hand-operated. In the other two yards there is only gin-pole control of the heavy material. All of the boats are left open at the end as long as possible, so as to permit the ready horizontal transference of material into the boat during construction.

In all the yards aggregate of the same size—under ¼ in.—is used in a mixture which becomes 1:2 mortar. At Detroit a Detroit River gravel is brought in by a barge. At Ithaca a Ludlowville gravel is brought down via the lake. Niagara grit is used at Tonawanda, and at Fort Edward iron-ore tailings brought from the mines at Port Henry. The latter are somewhat dark in color, but make a concrete which tests very high in strength.

Bending and placing is the most laborious operation in the barge-construction steel. Small pieces are bent by hickeys either on the field or on the boat, but for the 1-in. steel bending different devices have been developed. At Detroit the bender with its main reaction against a cast-iron segment of the proper curve has been set down into a concrete floor. At Fort Edward bulldozers are used which crimp the steel around the curve

RADIAL FRAME AT ITHACA MARKS LIMIT OF BENDING



AT DETROIT, BENDER FOR LARGE BARS IS SET IN CONCRETE FLOOR

step by step. The work is very slow and not particularly satisfactory. At Ithaca a crimp bender is also used, but a chord system of bending has been developed which makes the work quite rapid. On the outlying radius, beyond the bender, there has been set up a light frame on which are marked the steps of bending for every inch on the rod at the crimp. One man stands at the bender, moving it along inch by inch, while the other man pulls the end of the rod around to its proper mark on the circumferential frame. At Tonawanda a heavy cast-iron grating made up of 2-in. pieces with 2-in. openings has been set tight into a bending table. On this grating is marked the proper curve, and the bending is done by hand by dropping dogs into the openings in the grating as the bend proceeds. This simple device works admirably.

What Shall Be Done About The Railroad Question?

Francis Lee Stuart Reviews the National Railroad Situation and Proposes Return to Private Ownership

AFTER reviewing the facts which led up to Federal control of the railroads, Francis Lee Stuart, lately chairman of the Budget Committee of Eastern Railroads, proposed before the New York members of the American Society of Civil Engineers, Feb. 5, the return of the roads to private ownership as soon as enabling legislation can be passed. In reply to the question, "What shall the Government do with the railroads—Government ownership, or Government control for five years, or return to private ownership as soon as possible?"—he made the following statements:

Politics has no conscience, business morals or responsibility, and the danger to our methods of government from the political control of the railroad employees, possible and probable, under Government ownership prohibit its serious consideration.

From an engineer's standpoint, this country is young, and its natural resources have hardly been scratched, and an experiment in Government ownership would be extravagant, unfortunate, and undesirable on any basis, but primarily because it destroys the reward for initiative and sound judgment in the greatest field necessary for the proper development of our country and our national prosperity.

From the public's point of view, Government ownership throttles competition, which is a necessary incentive for proper service to the people in every part of the country and every city in the land.

On Control for Five Years

Some of the things which were ordered with propriety during the war, which should be undone at once and not five years hence, are:

The traffic departments of the various railroads, which were dispersed, should in great part be reassembled and rehabilitated at once.

An immediate abandonment as a national effort of an attempt at standardization of all manner of railroad necessities and methods. Such standardization, while it has a certain apparent first-cost economy when applied to quantity productions in the scheme of things in this country, tends to inefficiency, and should be a local question only in a limited locality. Our tools and methods are so crude that the national efforts should be to improve, not to standardize.

The horizontal raise in railroad wages of the entire country in one order which was necessary during the war is a pernicious destroyer of individual discipline, and debauches and atrophies the ambition of the men receiving such increase, and should be abolished in time of peace for responsible bargaining between employers and their own employees, as soon as possible.

The discomfort of the public, some of which was necessary during the war, should give way to even better facilities than offered before the war, the direct tax of an increase of passenger rates should be reduced to a minimum, even if an indirect tax of increased freight rates is necessary to pay the bills. The movement of the people freely around and about our country should be encouraged as increasing happiness and social well-being, and tending to a unity of spirit which is good for the body politic.

The terminal problem, which was made so acute by lack of ships and storage facilities, is largely one of changing our commercial methods, pooling facilities, and providing for the prompt unloading of cars. Belt railroads are needed and should be built in many places, but the matter is a local one peculiar to each community, and best handled as a financial policy of such community and not by the Federal Government.

We have great national efforts to make in world affairs, and the sooner we put the vim of an owner's interest back of the largest business interest in the country the better.

Return to Private Ownership

This country is so young and undeveloped that the railroad should exist and be encouraged primarily for the development of our material welfare—and, for the good of all, the railroads should be returned to their owners as soon as possible, so that their growth will naturally follow the normal business needs of the country, tested by business standards, and not directed into any predetermined course which would be determined by a centralized Governmental agency.

Returning the roads to their owners under old conditions would mean financial chaos in the country, and some legislation, with certain Governmental controls, is absolutely necessary.

The normal growth of our country requires that the railroads spend in the next five years at least $4,000,000,000 for improvements, betterments, and normal growth of our transportation service, and a continuing and enlarging amount thereafter to meet our growing needs. While the Government finds it necessary to put out varying issues of Liberty Bonds, it seems best that they buy the securities of the railroad as needed until the public regains confidence enough to take the investment out of their hands. This will require a possible advance of from $1,500,000,000 to $2,500,000,000, for which the railroads could be charged a high enough annual interest charge, over and above the cost of the money to the Government itself, to pay off the debt within 20 or 25 years.

The principle of a fixed financial policy and the control by the Government necessary to carry out such policy under all ordinary business cycles should be made a law by Congress. The control should be of an enabling nature and not more restrictive than is necessary, and might at the present time well consist of:

1. A control of rates initiated by the carrier. The rate question is largely an artificial issue and little understood by the public. The shippers of the country are chiefly interested in rate relationships, and the ultimate consumer in the amount of the rate, as he really pays the bill. We hear of the shippers through their lawyers, but the ultimate consumer is rarely heard, because his indirect tax due to the rate alone is so very small. There are possibilities in a more logical rate structure for settlement of most of the misunderstanding between the public and the shipper, and between the shippers themselves, for which the railroads usually

"hold the bag." In connection with the control of rates, the Government should have an unbiased economic study made for a more logical application of rates than at present.

2. The wage question of the railroad employee, like other inflations of the war, will be settled sensibly by public opinion. It does not seem a proper Governmental function to settle wage scales, and it is for the best continuing interest of labor itself that such questions should be returned as soon as practicable to be settled between employers and employees. It is necessary, however, that the Government take cognizance of such matters in the control of rates.

3. A control of unproductive expenditures required by the public, and particularly as to the grade-crossing elimination question, which threatens to be of serious financial importance in the near future, so that due cognizance may be taken of such expenditures.

4. A control of issue of securities for improvements and consolidations, and of the necessary railroad accounts. Generally, the weak lines should be consolidated with the strong, and the large lines prevented from becoming so large that they eliminate competition from any section of the country.

5. A control in safety matters.

6. A recognition that for the continuing solvency of the properties the voice of the general public, whose welfare is at stake, and the voice of the owners of the properties, should be heard with that of the shippers and representatives of the employees.

Principles for Legislation

In my opinion, the proper principles for legislation for a fixed financial policy should be based on an average railroad efficiently operated, receiving, as a minimum, a fair profit for the transportation it has to sell, and that fair profit must include: (1) An adequate going return on the investment over the cost of proper service to the public; (2) a return for such money as is borrowed for improvements required by the growth of the country, which will include the cost of the money plus an added equity to the corporation in compensation for extending their credit and brains as collateral for such money; (3) the further right to build up such surplus as this class of business, wisely conducted, should have in reserve for emergency.

With the principles of a policy fixed, and controls whereby it may be made effective, the means for carrying out the purpose could be more flexible and could consist of a number of commissions with some coördinating force, all safeguarded in certain cases by right of appeal to proper courts.

The entire matter is of such importance to the whole country that, if this session of Congress cannot settle the question, then an extra session should at once be called for this purpose.

Courses in Industrial Hygiene and Medicine

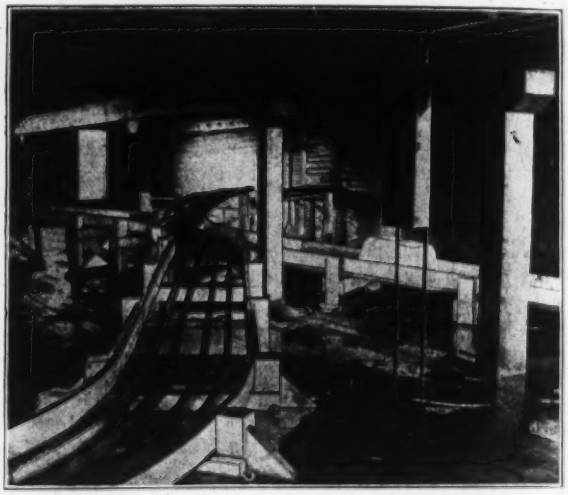
A course in industrial hygiene and medicine was recently given at Yale University under Prof. C.-E. A. Winslow, and a similar course is to be given at Ohio University, according to a statement issued by the Working Conditions Service, Department of Labor.

New Car-Icing Plant Accommodates Twenty-Eight Cars

Modern Ice-Handling Machinery Operated by Electric Motors—Three-Deck Platform Is More Than 1000 Ft. Long, With Conveyor Service

By E. F. Ackerman
Assistant Engineer, Illinois Central Railroad, Chicago

At WATERLOO, Iowa, the Illinois Central has replaced its old car-icing plant, erected 32 years ago, by the largest plant now operated by that company. Modern ice-handling machinery inside the building, gravity conveyors, and three-deck platforms over 1000 ft. long, make the new plant far superior to the one it replaces, as 28 cars can be spotted and iced in one and one-half hours without moving the train, whereas only



INCLINES TRANSFER CAKE ICE TO OUTSIDE PLATFORM

nine cars could be supplied by the old plant, and it required four hours to ice a train. Instead of hand labor, the new plant uses electric motors for mechanical handling; loss from melting in the new plant is practically nil, because it is built like a refrigerator with insulated walls and air-tight openings. The plant is located on the main line between Omaha and Chicago, for the purpose of re-icing the refrigerator cars loaded with fruit and meat on their way to Eastern markets.

The new plant consists of three separate units, combined in one large building which has a ground area of 59 x 282 ft. At either end of this building is a storage room 55 x 124 ft. and 35 ft. high in the clear, each with a capacity of 5000 tons of ice. Between the storage rooms is a three-story building 30 x 55 ft., known as the ice-handling room. The first floor is the receiving room, the second floor is used in taking cake ice from the storage room, the third floor is the crusher room and salt-storage room.

Along the side of the building is a three-deck platform which extends beyond each end, to a total length of 1008 ft. The first deck is the receiving deck, and is built on an incline, so that ice taken from the cars slides down onto two conveyors, each 123 ft. long and with a capacity of 24 full cakes per minute. These con-

ICING STATION WITH OUTSIDE PLATFORMS 1008 FT. LONG FOR ICING 28 REFRIGERATOR CARS

veyors push the ice to the receiving room, in which slides are built which convey the ice by gravity to the combined elevating and lowering machines, of which there is one for each storage room. These elevating and lowering machines have a capacity of 16 full cakes per minute, and are arranged so that ice can be taken from the receiving room and elevated to any level in the storage room. They can also be reversed, to take ice from the storage rooms at any level and convey it to the different floors of the ice-handling room. Each of these machines has two motors; one operates the hoist and the other operates the brake, which is so connected that when the power is cut off from the hoist motor the power of the brake motor is automatically turned on, and this in turn applies the brake.

Conveyors Can Be Reversed

On the second floor of the ice-handling room slides are built which take the ice from the elevating machines and deliver it by gravity to two conveyors, which run to each end of the second deck of the platform and are 484 ft. long. Ice can be taken from these conveyors at any point along the platform. They have a capacity of 18 full cakes per minute, and can be reversed so that the ice not used is run back into the storage room.

On the third floor, or crusher room, ice is taken from the elevating machines and by gravity runs down inclined slides into two Creasey ice crushers. These crushers have a capacity of 60 tons of ice per hour, and are located on an elevated platform so that the crushed ice can be dumped into carts which are then hauled by men onto platforms and dumped into a movable chute; this runs on rails along the entire length of the third deck, and conveys ice into the hatches on top of the refrigerator cars.

In the ceiling of this crusher room is built a large hopper-shaped salt bin of 30 tons capacity, with a gate in the bottom to deliver the salt into cars which are hauled on the top deck of the platform to hoppers placed at every third post. Under the receiving platform is a concrete hopper with a concrete chute, into which salt is dumped from cars and run by gravity into buckets bolted on an endless belt. This conveys the salt into salt bins in the roof of the crusher room.

The entire building is built as a refrigerator room, the walls being double and consisting of two thicknesses of ⅞-in. sheathing nailed on 3 x 10-in. studding, with heavy roofing paper between on the inside, and one thickness of ⅞-in. sheathing and 6-in. No. 115 lap siding with heavy roofing paper between, nailed on the outside between the sheathing and the studs. Granulated cork is packed to a height of 10 ft., and above that fine shavings are used to the under side of the rafters.

The roof is double, the under side of the rafters being sheathed tight with ⅞-in. sheathing, and the top of the rafters is sheathed with 1½-in. sheathing open at the eaves, where a small monitor is built at the peak of the roof the whole length of the building. This forms an air passage between rafters and keeps the under side of the roof cool.

The wall and floor foundations are of concrete, the floor being built of 4 x 4-in. cypress sleepers, upon which 2 x 6-in. rough cypress planking is placed 1 in. apart, to form an air passage and allow drippings to run off into the sewer. All the doors to the storage room and crusher room are double refrigerator doors.

Construction Under Severe Conditions

The erection of this plant was accomplished in one of the most severe winters ever known, work being carried on in temperatures as low as 12 deg. below zero, and material being shipped from the East in the worst snowstorm. The cars with machinery were stalled in the snow for months, and the first ice had to be stored with the aid of a steam engine and an inclined conveyor.

The work required a total of 2616 cu.yd. of excavation, 640 cu.yd. of concrete, and 320,000 ft. bm. of lumber. The plant was planned and designed in the office of F. R. Judd, engineer of buildings, Illinois Central R.R., and the writer was locally in charge for the railway company. The construction work was done under contract by the J. W. Zitterell Co., of Webster City, Iowa, with H. Bearman as superintendent.

Surveyed 38,136 Square Miles Last Year

Detailed soil surveys covering 38,136 square miles were made during the fiscal year 1918 by the Bureau of Soils of the United States Department of Agriculture. Prior surveys of 445,825 square miles make the total 483,961 square miles. Twenty-two states and four bureaus of the Federal Government are now actively coöperating in this soil-survey work.

Operating an Employment Bureau for Civil Engineers

How a Technical Society Conducts a Registration Office—Tries Also to Place Employed, But Not Satisfied Men

By C. S. Rindsfoos
Chairman, Registration Bureau, Cornell Society of Civil Engineers, 30 E. 42nd St., New York

UNEMPLOYMENT in the engineering profession threatens to become serious in the near future, so that greater interest than ever before is being displayed by the various Governmental and society employment bureaus which have operated, until recently, in a most perfunctory manner. How the Registration Bureau of the Cornell Society of Civil Engineers is now being conducted may therefore prove of interest to many other similar societies that have such work under way or in contemplation.

The writer believes that—important as is the question of assisting the unemployed, in which class discharged soldiers and sailors would fall—there is one possibility of service, on the part of such bureaus, of much greater and abiding importance; namely, the shifting of the man who is doing unprofitable, uncongenial or unsatisfactory work into work that he can do to better advantage—in short, in helping the "misfits." Nothing is more sad than to see a man doing work for which he is not fitted. Many a man starts on the wrong path or becomes sidetracked and, being burdened with a family or other private responsibilities, lacks the time, capital, ability or nerve to change to that position where his native talents have a chance to display themselves. At this juncture a helping hand, pointing the way to greater opportunities, is a fine thing not only for the man but for his profession and society in general, tending to efficiency and greater productiveness.

Every Man Cataloged

Keeping this in mind, the bureau took the first step in its plan by cataloging every man who had ever attended the college, whether he was satisfactorily employed or not; whether he was a beginner or a man of high attainments. A questionnaire with inquiries of every sort necessary to a knowledge of a man's capabilities was sent to every Cornell civil engineer, some 2000 in number. The idea in cataloging all the men was, first, that in no other way could it be determined how many were desirous of a change; second, that any man at any time might become a candidate for a new position; third, that every man, practically speaking, will consider a change if offered sufficient inducement either in salary, responsibility, or chance for service, and fourth, that the sympathy and help of the satisfied men was necessary to the bureau and that they would support a bureau more readily if they were a part of it and received the notices sent out from time to time.

These questionnaires are four-page, letter-size, and are filed by number (without reference to the alphabet). All correspondence with reference to a man's record received subsequently is filed with the questionnaire, so that the questionnaire becomes a folder with complete data, up to date, and immediately available. Follow-up cards are sent from time to time to keep the records up to date, and these also go into the questionnaire folder.

A card index (size 3 x 5 in.) is maintained to go with the questionnaires, arranged alphabetically, each card containing the name of the man and his number—nothing more. By means of this index, given a man's name, his number can be immediately determined and from the number his questionnaire is located.

Another card index (size 3 x 5 in.) is maintained and arranged by classes. This index is divided into two main groups, labeled "satisfied" and "not satisfied." Unemployed men are filed in the latter group until employed, when their cards are transferred to the "satisfied" group. Should a man become dissatisfied with his employment, his card is transferred from one group to the other, without disarranging the regular files.

Each of the two main groups is subdivided by salaries. For example, cards of all men who place a value on their services of, say, $250 per month are placed between the tabs 200 and 300. Men who value their services at, say, $350 have their cards placed between the tabs 300 and 400, and so on. Should a man's value increase so that his subsequent reports show that, whereas at one time he would consider a $250 position and his card was so filed, he now would consider nothing less than $350 his card is simply transferred, without deranging the regular files.

Each salary group is further subdivided by symbols which indicate whether a man is a candidate for an "executive," "administrative," "engineering," "sales," "clerical," "commercial," etc., position. The card is so ruled that the symbol and salary may be changed from time to time, so that a clerk, without even knowing what the symbols mean, can place the card in the right slot with a maximum of speed and accuracy. For example, if the last symbol on a card is 1-450-NS his card belongs in the "Not satisfied" group, subdivision 400-500 (salary) sub-subdivision 1 (executive).

Suppose an employer calls for a man to fill the following position: (1) Superintendent of construction; (2) salary, $450 per month; (3) age wanted, 30-40; (4) type of work, factory building, reinforced-concrete, pile foundation. It requires a moment to pick the group of cards classified "administrative—400-500." The corresponding questionnaires are then taken from the questionnaire file and those selected which represent men of about the age and professional attainments required. Any special requirement such as "married man preferred," "man capable to design as well as construct wanted," etc., can be determined from the questionnaire. An exact copy of each questionnaire of each logical candidate is then sent to the employer, and the original is returned to the file. A metal signal is then placed on the card of each man recommended, for purposes of follow-up. A notice is also sent to each man, telling him he has been recommended for the position.

It will be seen that every effort is made to serve the employer by only sending "logical" candidates. If no man seems available, the inquiry is referred to one of the other college bureaus, which reciprocate in like manner.

Many other forms and devices for follow-up purposes, for obtaining inquiries from employers, and to save dic-

tation in correspondence, are used, but it is thought the part here explained gives the gist of such features as are novel. The plan was evolved after a careful study of many other systems, and it is believed that by combining desirable points from several with ideas of our own a good workable system has resulted.

Loss of Head in Sewage Sludge Pipe at Toronto, Ontario

Experiments Made on 12-Inch Cast-Iron Sludge Main After Five Years of Use Give Value of $n = 0.0168$ to 0.0181

By T. H. Nevitt
Superintendent of Sewage Works, Toronto, Ont.

OWING to the necessity of obtaining some data as to the loss of head due to pumping sludge through pipes, an experiment was made at the main sewage-disposal works, Toronto, on the 12-in. cast-iron sludge discharge main. The data were required for use in a report on sewage disposal.

The sludge experimented with was obtained from the sedimentation tanks, and was not more than 10 days old. This sludge was released from a tank through four 8-in. valves situated at the apex of the bottom hoppers, and flowed through a 10-in. cast-iron pipe, on a 2% grade, to a sludge well in the pumping station. Here it flowed into an 8-in. centrifugal pump and was raised about 35 ft. and discharged through 400 ft. of 12-in. cast-iron pipe and some 200 ft. of 10-in. spiral-riveted pipe to the sludge lagoon.

After leaving the pumping station, the pipe is supported on posts at a distance from 10 to 6 ft. above the ground, and turns down just below surface level in the lagoon, where it discharges. The pipe was laid some five years ago, on a grade of 1 in 80, which it still retains, although, through the action of frost on the supporting posts, the alignment is not so good. Pump tests show that this grade is sufficient to carry the sludge away by gravity.

As the pipe ordinarily does not flow full, it was necessary to cause it to do so, and this was done by making a siphon at the discharge end, the height of which was a little greater than the loss of elevation due to the grade of the pipe.

For the purpose of the experiment, a length of 12-in. pipe south of the station was selected which was unaffected by either valves or bends. In fact, no obstruction to the flow occurred within 12 ft. of either end of this test length, which was 240.5 ft. long.

To measure the loss of head, two ¼-in. holes were drilled through the cast-iron pipe on its horizontal diameter, one at each end of the section selected, and, to insure the entrance being square and sharp, these holes were cut with a sharp drill running at high speed. The pipe was then counterbored half way through its wall and tapped to take a ¼-in. water pipe. At the north end, the ¼-in. pipe was turned down and then run horizontally to a point 6 in. north of the middle of the test length, while at the south end the pipe turned north and ran horizontally to 6 in. south of the middle. At this point, a mercury U-tube was inserted and connected to the ¼-in. pipe by rubber tubing. Quarter-inch gate valves controlled the pipe at the north and south ends and ¼-in. pet-cocks at the center. The scales on the U-tube could be read to ⅛ in. and estimated to $\frac{1}{16}$ inch.

OBSERVATIONS ON FLOW OF SEWAGE SLUDGE THROUGH 12-INCH CAST-IRON PIPE AT TORONTO

Head in Pipe: Loss of Inches of Mercury	Head in Pipe: Feet of Water	Feet of Water per 100 Ft. of Pipe	Discharge, Cu. Ft. per Sec.	Area of Pipe, Sq. Ft.	Velocity in Pipe, Ft. per Sec.	R	S	C	n	Hazen & Williams' Formula, C for Observed Loss of Head
3½	3.41	1.415	5.00	0.785	6.36	0.25	0.0141	108	0.017	115
3	3.15	1.306	4.92	.....	6.26	.....	0.0131	110	0.017	118
3½	3.41	1.415	4.90	.....	6.24	.....	0.0141	106	0.017	113
3½	3.41	1.415	4.88	.....	6.21	.....	0.0141	105	0.018	113
2½	2.89	1.199	4.81	.....	6.12	.....	0.0121	111	0.017	122
3	3.15	1.306	4.79	.....	6.10	.....	0.0131	107	0.017	115
3½	3.41	1.415	4.77	.....	6.07	.....	0.0141	103	0.018	110
3	3.15	1.306	4.72	.....	6.01	.....	0.0131	104	0.018	114
2½	2.89	1.199	4.70	.....	5.98	.....	0.0120	109	0.017	118
3½	3.41	1.415	4.69	.....	5.97	.....	0.0141	101	0.018	108
3	3.15	1.306	4.67	.....	5.94	.....	0.0131	104	0.018	112
3	3.15	1.306	4.65	.....	5.92	.....	0.0131	104	0.018	112
3	3.15	1.306	4.62	.....	5.88	.....	0.0131	103	0.018	111
2½	2.89	1.199	4.55	.....	5.79	.....	0.0120	105	0.018	113
2½	3.02	1.253	4.50	.....	5.73	.....	0.0125	102	0.018	109

The volume of sludge was measured by a 12 x 6-in. venturi meter and register indicator recorder of the latest type. The indicator has a uniformly divided scale which can be read very accurately.

Before the experiment was started, the ¼-in. piping was carefully filled with clean water and all air was expelled; the watches of the two observers and the recorder clock were regulated as to time. Readings were taken at 5-min. intervals. At the end of an hour the observers changed places, and the experiments were continued for another hour. Some difficulty was experienced in reading the U-tube on account of the continual fluctuation of the mercury column, but the reading at the 5-min. interval was that recorded. The fluctuation was fairly uniform until a discharge of 4½ sec.-ft. was reached, below which it became very erratic. In consequence, these results were neglected. This was for two reasons: (1) On account of the small differential an error of ⅛ in. in the reading made a large percentage error, and (2) the flow had become turbulent due to choking in the sludge pump from heavy sludge and also the low discharge.

The value of n was determined by substituting in Kutter's formula for C and solving for n in each case. The results show a variation from 0.0168 to 0.0181, which is probably accounted for by variations in the density of the sludge. For comparison, the value of C in Hazen and Williams' formula was worked out on the slide rule. The results show that for Toronto conditions the addition of two years to the age of the pipe permits the Hazen and Williams' tables for water to be applied very closely.

Pint samples of sludge were taken every 10 min. at the discharge end of the pipe, and collected in a pail. At the end of the experiment, these were stirred thoroughly and a sample was taken for analysis.

The sludge analyzed as follows: Specific gravity, 1.01; moisture, 95.9%; solids, 4.1; percentage of dry solids which are volatile, 50.5; ash, 49.5%. The temperature of the sludge was 54° Fahrenheit.

The experiment was carried out under the general supervision of R. C. Harris, commissioner of works for the City of Toronto, G. G. Powell, deputy city engineer, and W. R. Worthington, assistant engineer in charge of sewers, and under the writer's immediate direction.

Structure and Strength of Overheated Rivet Steel

Failure of Long-Grip Rivets Led to Study of Overheating, Annealing and Forging—Microscopic Grain Structure and Strength Properties Investigated—Embrittling Effect of Overheating Made Clear

By S. H. Graf

Professor of Experimental Engineering, Oregon State Agricultural College, Corvallis

RECENTLY, in the construction of a steel building in Portland, Ore., it was necessary to rivet together a number of plates such that the thickness of the member thus built up was about 5 in., the rivets being thus rather long. The heads of some fifty of these rivets snapped off after cooling. It seemed that the manipulation had been little if any different from the usual practice, and the cause of this failure was therefore somewhat of a mystery. It was thought by some that the cause lay in inferior or defective material. A microscopic examination of the body as well as the field head of one of the failed rivets was made, and revealed in the body of the rivet the peculiar broken structure shown in Fig. 1. The head showed a very different structure, as shown by Fig. 2. Those familiar with work of this nature would recognize the structure in Fig. 1 to be that characteristic of badly overheated steel, while that in Fig. 2 more nearly represents the normal structure.

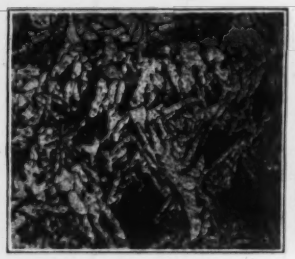


Fig. 1. Body rivet (x200)

Fig. 2. Field head (x200)

STEEL STRUCTURE IN ONE OF THE RIVETS THAT FAILED

It is quite generally known that the overheating of steel causes a coarsening of its structure and a deterioration of its qualities. However, cases where this is of practical importance are uncommon enough to be interesting whenever they do occur.

To make conclusive the evidence of overheating as the cause of failure of the rivets in question, it was decided to conduct a little laboratory research, imitating conditions which might under different circumstances obtain in practice, and then to make studies of the steel structures and physical properties resulting from these various treatments. It was further desired in this study to determine, if possible, why, under most conditions, apparently no damage is done by a given treatment, while in other cases failure results from what is apparently the same mode of manipulation.

Rivet steels may contain from 0.05 to 0.25% carbon, according to the strength required. Ordinarily, the carbon content is in the neighborhood of 0.12%. For the purpose of the proposed microscopic tests, two ¾-in. round bars were selected, differing in grade of steel, one containing 0.11 and the other 0.23% carbon. The first of these is similar in grade to the rivets which failed in the instance referred to, while the other represents rivets of the highest carbon content customarily used. Fig. 3 shows the normal structure of the first of these, and Fig. 8 that of the second.

Pieces of both of the test bars were subjected to the following manipulations:

(a) Held at 2100° F. for 10 min. and air-cooled.

(b) Heated in the forge until sparks began to be thrown off, and held at this temperature for two minutes.

(c) After treatment b (same specimens), refined by heating to the upper limit of the critical range plus 100° F. for 15 min. and air-cooled (1700° Fahrenheit).

(d) Using a fresh piece of the bar 2 in. long, treatment b, followed by upsetting the piece to one-half of its original length and forging out to about ¾ in. square.

Micrographs are shown in Figs. 4—7 and 9—13 of the results of these various treatments. All of these are to a magnification of 400 diameters, with the exception of Fig. 11, which is to only 100 diameters, the structure in Fig. 10 being so coarse that the entire photograph does not show one whole grain. The following table shows the grain size (in grains per square millimeter) resulting from the various treatments. The counts are necessarily only approximate in some cases, owing to the broken structure.

CHANGES IN GRAIN SIZE OF STEEL PRODUCED BY HEATING AND FORGING CONDITION AND TREATMENT OF STEEL

Carbon Content	Normal	(a)	(b)	(c)	(d)
0.11%	15,500	4,100	680	10,900	6,800
0.23%	7,100	3,200	168	17,500	12,400

These figures indicate quite startling changes. The soaking for ten minutes at 2100° F. has, in both cases, increased the grain size quite materially, and even the short heating at a sparkling temperature (about 2500° F.) has increased the grain size enormously, and in addition to this has considerably altered the character of the structure itself. Treatment c has resulted in a wonderful refining of the grain. In the case of the higher carbon content the grain is even finer than it was in the original steel. The forging treatment (see Figs. 7 and 13) has resulted in a very material grain refining, especially in the case

FIG. 11. STRUCTURE OF OVERHEATED STEEL OF 0.23% CARBON

Magnified 100 diameters (same as Fig. 10) but lower magnification used because structure is so coarse that Fig. 10 does not show an entire grain.

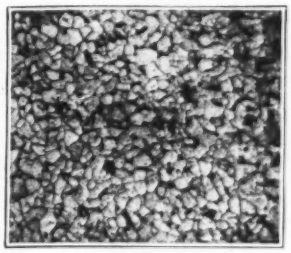


FIG. 3

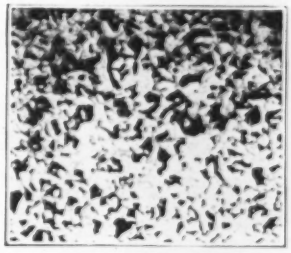


FIG. 8

Normal Structure

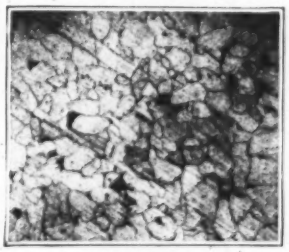


FIG. 4

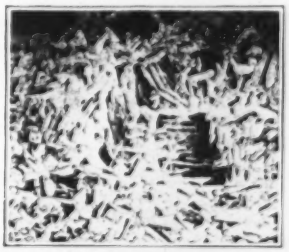


FIG. 9

Held at 2100° for 10 minutes and air-cooled

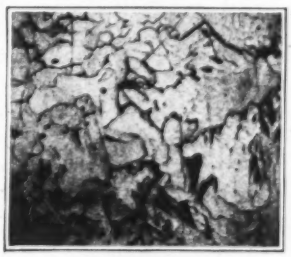


FIG. 5

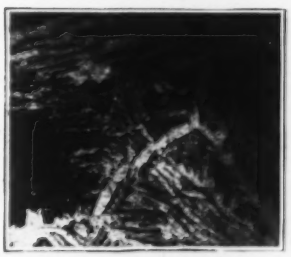


FIG. 10

Overheated

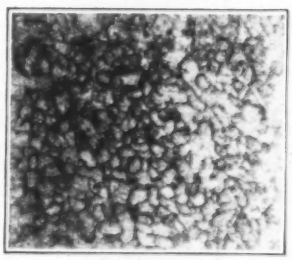


FIG. 6

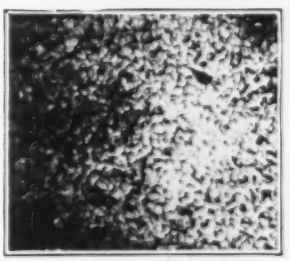


FIG. 12

Overheated Specimen Refined by Heat-Treatment

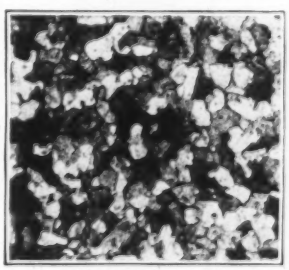


FIG. 7

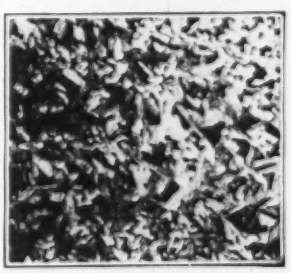


FIG. 13

Overheated Specimen Refined by Forging

STEEL OF 0.11% CARBON

STEEL OF 0.23% CARBON

(Reproduced one-half linear size of original microphotographs)

of the higher carbon content, where the grain has been rendered somewhat finer than it was originally.

Contrasting Figs. 5 and 10 with 7 and 13 shows why the structure in the head of a rivet may be normally fine, while that in the body (especially in a long rivet) may be extremely coarse. The head has been forged and thus refined. The body has simply cooled from a very high temperature, just as was the case here in treatment b. A thermal refining of the grain, as accomplished by treatment c, is of course not possible with rivets, but is practicable in the case of forgings, and is always applied to high-grade steel castings.

The micrographs already referred to show beautifully the changes in structure resulting from the different treatments, but the question arises, Just what physical properties correspond to these different structures? In order to answer this question, repeated-stress tests were made on samples of $\frac{3}{8}$-in. rivet steel, in carbon content lying between the two steels which were studied microscopically. The tests were made by means of a Landgraf-Turner alternating impact testing machine; the results are given in Table I.

EFFECT OF HEATING AND FORGING ON THE PHYSICAL PROPERTIES OF STEEL

TABLE I—REPEATED-STRESS TESTS

Condition	Alternations of Stress 1	2	Ave.
Normal bar	350	379	364
Overheated bar (treatment B)	183	61	122
Overheated and heat-treated bar (treatment C)	283	316	300
Overheated and forged bar (treatment D)	244	255	249

TABLE II—TENSILE TESTS

Condition	Yield Point Lb. per Sq.In.	Ult. Strength Lb. per Sq.In.	Ductility, %	Reduction of Area, %	Character of Fracture
Normal bar	45,600	65,100	31.5	72.2	Very fine silky
Overheated bar (treatment B)	70,700	71,400	4.0	10.8	Coarse crystalline
Overheated and heat-treated bar (treatment C)	47,800	66,200	17.5	55.8	Fine silky

The alternating-impact test is quite a severe one, and yields comparative results which measure primarily the toughness of the material. An inspection of the results shows that the structure represented by treatment b and Figs. 5 and 10 is very brittle and unreliable. Either heat-treating or forging very largely restores the original qualities of the material so far as toughness is concerned.

Tensile tests were made in a 50,000-lb. Riehlé testing machine on the same material as used for the repeated-stress tests. The results were as given in Table II.

These tests show quite conclusively what happens. In the overheated specimen the yield-point is raised so high that it closely approaches the ultimate strength. The ductility and reduction of area are reduced to a small fraction of what they are normally. The coarse crystalline nature of the structure is also in evidence. The heat-treating greatly improves the material, bringing it back nearly to its original good quality. The very low ductility in the case of the overheated specimen shows why rivet heads may snap off when such material cools from a high heat to atmospheric temperature. The contraction on cooling under these conditions, especially with long rivets, is sufficient to stress the rivets beyond the elastic limit of the material, so that if the ductility of the metal is much reduced the rivets will actually be pulled in two by the contraction.

It must be understood, too, that rivets allowed to soak in a forge for a considerable time may be coarsened in structure far beyond the point reached by the specimens in these experiments, so that the ductility may be reduced to almost nothing. In the case of such long soaking, there may also be an absorption of carbon from the fuel in the forge, such as takes place in case-hardening. This effect was looked for in the present study, but was very slight, if not entirely absent.

It is often thought—and the statement is sometimes made in case of a failure exhibiting a coarse crystalline structure—that the material has "crystallized" in service. The latest research has shown—at least in the case of ordinary low-carbon steels—that there is no such change of grain size, and that the coarse structure was there originally in the fabricated article, caused by some error or accident in manipulation either in the production of the steel or in its subsequent treatment.

In conclusion, it may be said that this study of rivet steels shows clearly the danger of overheating rivets (and steel generally), either by holding at a very high temperature for a short time or by long soaking even at temperatures ordinarily considered safe.

Shipbuilders Encouraged to Think at McDougall-Duluth Yard

TWO new features have been introduced in the McDougall-Duluth Co.'s shipyard, Duluth, Minn., to increase coöperation between the men and the management. Most novel of the two is an Invention Division, which the yard monthly, the *Riverside Review*, says has just been established by the company to give legal and technical assistance to any employee of the company who may have an idea worth patenting. S. G. Stevens, patent attorney of Duluth, has been retained to give advice.

Any employee can obtain Mr. Stevens' assistance through the industrial department of the shipyard. The service is intended to assist in (1) developing an idea to the form of a patentable invention; (2) comparing it with prior patents that conflict or that may be helpful, and (3) bringing out its commercial possibilities. A plan for financial assistance in developing and patenting inventions for its employees is under consideration by the company.

Revival of the suggestion box is another means by which the company aims to enlist the coöperation of the yard workers. The box was established more than a year ago, in the early days of the yard, but during the building and great expansion of the new plant it ceased to exist. Now A. Miller McDougall, general manager, has reëstablished the suggestion box and will take personal supervision of it.

Keeping Economy of Operation Paramount in a Shipyard Layout

Despite Cramped Quarters Moore Plant on San Francisco Bay Adhered to Standards for "After-the-War" Basis—Ways Served by Derrick Towers—Transportation on Zone System—Ordering Methods

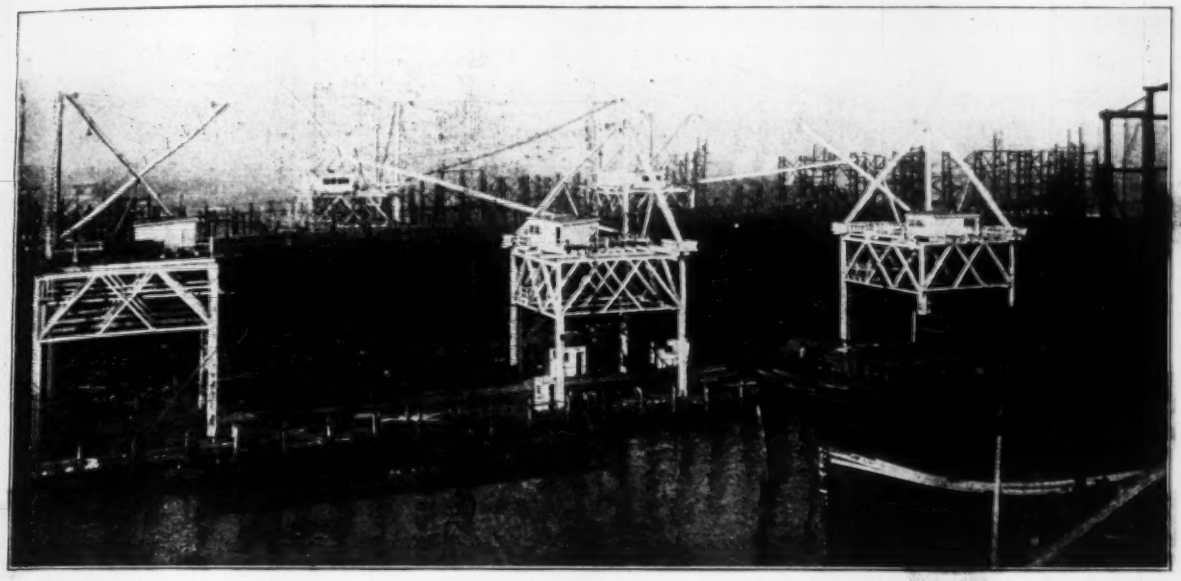


FIG. 1. MOORE SHIPYARD USED DERRICK TOWERS INSTEAD OF TRAVELING CRANES FOR BERTH SERVICE
Material is delivered to wide storage spaces alongside the ways by locomotive cranes. The latest derrick towers are 70 feet high.

LIMITATION of yard space at the Moore shipyard on San Francisco Bay called for careful attention to layout, in order that material could be handled economically. Studies of the material-handling methods were continued while the yard was in operation, and as it expanded improvements in the system continued to be made. By the time the plant had grown from two ways to ten, there had been developed the slogan of "economy of operation on after-the-war basis," and efforts were consistently directed toward adhering to that standard. Expansion on both sides of the original plant and the fortunate selection of main building sites for the early development are factors without which this would have been impossible.

Important steps in attaining the desired economy of operation are the zoning of locomotive-crane travel and the card-index and requisition systems used for recording and ordering out plates and shapes. There has been constant effort to avoid interference in delivery and fabrication and to find storage space, particularly along the ways, where material ready for the boat could be located most conveniently. Elbow room in the fabrication yard has been insisted upon, and continual attention is given to plate-shop organization.

It is also notable that because of the delays and difficulty attendant upon getting delivery from Eastern factories some of the shop equipment and several cranes were designed and built in San Francisco.

The machines in the angle yard are set up under "umbrellas" consisting of four piles supporting a central roof and four radial jib cranes. The booms of these cranes are I-beams hinged to the four corner piles; they constitute an important feature in time-saving in the angle yard. The booms carry differential chain blocks and a workman can swing the boom by one hand with the same movement that draws the block along to the desired point. These "umbrellas," developed in the San Francisco Bay region, illustrate the simplicity of device and economy of construction notable in many of the Western yards. Their open construction indicates how the climatic advantage favors this region as a shipyard location. In winter or summer the slight shelter afforded by the umbrella is sufficient protection for the workmen

Raw Steel Card-Indexed—The angle yard is laid out to handle steel shapes up to 80 ft. long, weighing 20 lb. per foot. Here, as well as in the plate yard, materials are classified for storage according to size; there is no attempt to segregate material for any particular hull. Coupled with this plan is a card-index system whereby each piece of steel, as it is received from the mill, is recorded on a card. The card (Fig. 4) has a space for the mark by which the piece has been ordered, the number of the hull for which it is intended, the size and thickness of the piece, the date received into the yard and the number of the order under which it goes out of the yard to the shipfitters. There is also a space for entering the sheet number in the list of material which is kept separately for each hull. By the use of this system it is possible to draw material for any hull

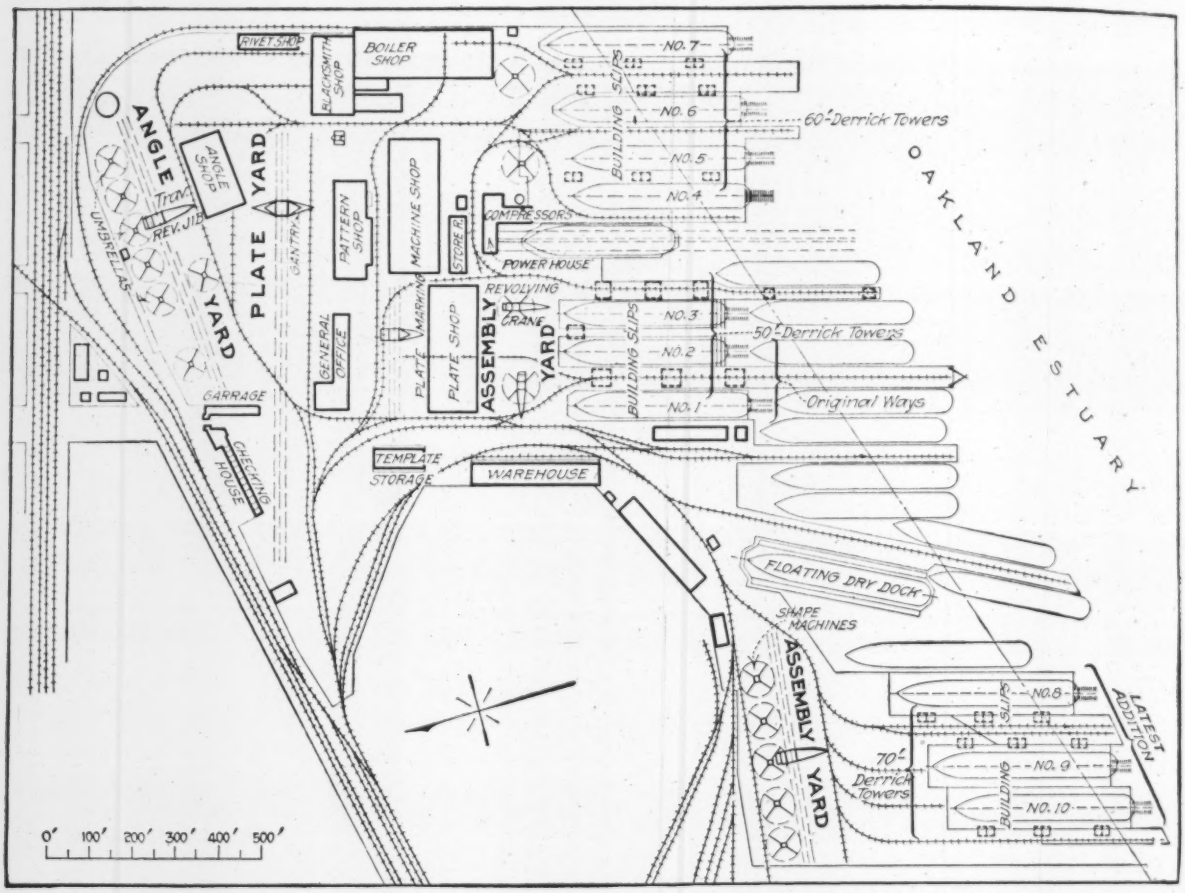


FIG. 2. SPACE LIMITATIONS RESPONSIBLE FOR IRREGULAR PLAN OF SHIPBUILDING AND DOCK COMPANY'S YARD

from the general stock supply without complicating the records, and yet there is convenient record of how such material was used.

The angle shop has equipment for cold and hot bending of angles and shapes, including two 9-burner 50-ft. oil furnaces for heating the longer pieces. Realizing that bent shapes are the greatest source of trouble in the erection of vessels, particular attention was devoted to the equipment of the angle shop, and careful study has been given to its arrangement and method of operation.

Yard Crane Equipment—Cranes for service over the material yards were not to be had in time from Eastern plants; therefore, three traveling cranes with revolving booms and two stationary revolving cranes were built to special design, and a cantilever gantry (Fig. 3) for the plate-storage yard was rebuilt from material already on hand in the old yard. Each of the revolving cranes has a 90-ft. counterbalanced boom, and as auxiliaries four jib cranes, one on each corner of the main tower. The jib cranes, hinged to swing through an angle of about 150 deg., are found exceedingly useful, particularly on the stationary cranes in the fabrication yard. (See view, Fig. 7.) Eight locomotive cranes are used at the Moore plant, seven 15-ton and one of smaller capacity. Because of the long haul from end to end of the trackage, it has been found economical to limit the travel of cranes to certain zones; that is, to each crane is assigned a section of the trackage beyond which it does not operate except under special orders. Under this plan loss of time in re-handling from crane to crane is actually very little, cer-

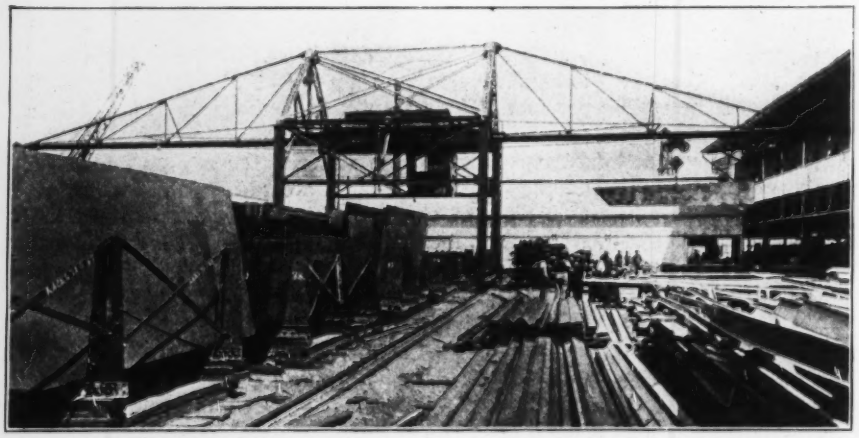


FIG. 3. CANTILEVER GANTRY IN PLATE YARD WAS BUILT FROM MATERIAL ON HAND

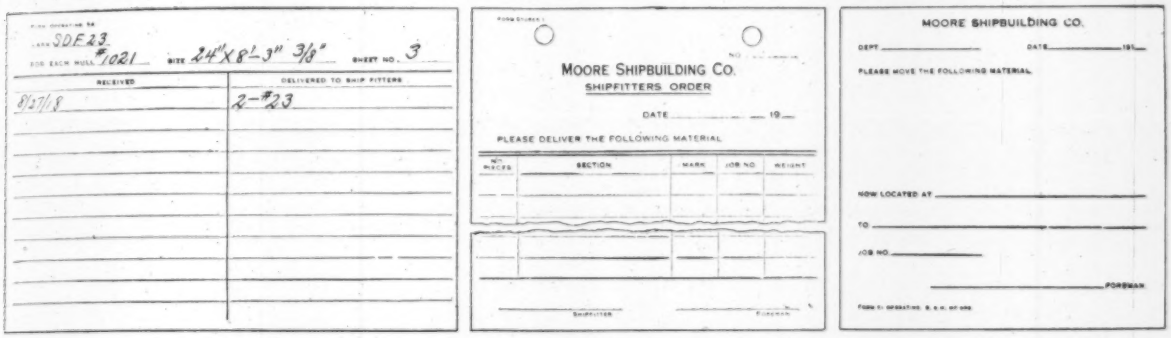
tainly much less than that resulting from waiting for right-of-way past a crane in another zone. The plan has been made most effective by endeavoring to select as far as possible zones which are between natural terminals—as from plate storage to assembly yard, or between any other two points where rehandling would ordinarily be required. The time of the locomotive cranes has been still further conserved by the use of eight one-ton Ford tractors which reach all parts of the yard and the storage along the ways. These handle all small material and relieve the locomotive crane of many minor errands.

Ordering Material and Transportation—Material is taken from the storage yards on a "shipfitters' order," signed by the shipfitter and the foreman, Fig. 5. This order indicates the number of pieces and the exact kind of material required, and gives the number of the hull on which it is to go. The locomotive-crane foremen turn these slips in daily to the material superintendent's office. From them, together with the checked invoices on incoming freight, the stock records are kept up to date. Shapes and plates are recorded in separate card indexes, the cards being filed alphabetically by "mark," which is the designation by letter and number on each material shipment received.

A very simple plan which has saved much time and confusion in this yard is the scheme of using a foreman's requisition for ordering material moved for a special purpose. Formerly, it was necessary to find the superintendent of the material-handling department or one of his assistants and get permission to have a locomotive crane do the special moving job. This is now unnecessary; all foremen are authorized to fill out and sign a special form, about 4 in. square, which, when presented to the nearest craneman, authorizes him to move the specified material as requested. On this form, Fig. 6, there are filled in the date, the description, the present location and the destination of the material, and the number of the hull for which it is needed. These slips, turned in daily by the locomotive-crane men, give a check on the time and the hull number to which the special service should be charged.

Derricks Serve Ways—The ways are served by derricks on stationary wood towers. On the first ways these were made 50 ft. high, on later ways a 60-ft. height became standard and finally, in order that troop ships could be served easily, new ways were equipped with 70-ft. derrick towers. By using stationary derricks with long booms the maximum of undisturbed storage was made available in the limited space between ways. The ways in the original plant had two derricks per tower with three towers between ways. In later additions the plan has been changed to single-derrick stationary towers, three to each way. The towers are of wood. The booms are 105 ft. long and can place 12½ tons at a 65-ft. radius, which is enough to reach beyond the center of the ship.

An assembly or fabrication yard at the head of the slips is used for building up heavy work such as transverse units, pillars, hatch girders, etc. This yard, shown by the view, Fig. 7, is served by two 3-ton revolving cranes which deliver to the derricks at the forward ends of the ways or to flat-cars for the derricks farther down the ways. Near the three new ways in the far end of the yard a storage space is provided for finished shapes and plates. From this storage a traveling crane with a revolving boom will deliver the material to flat-cars, from which it will go to the storage alongside the way. The policy is to keep the storage along the ways always as near capacity as possible. As soon as the final plates for the ship have been taken from one section of the pier storage, material for the next boat is assigned to that space. As the first boat nears completion as much material as possible is stored on the pier for the one that is to follow.



FIGS. 4, 5 and 6. MATERIAL INDEX CARD, WAY ORDER, AND TRANSPORTATION ORDER FORMS

Fig. 4. Each piece of steel received is recorded on a card like this, the cards being filed according to the piece mark. Fig. 5. This form with two signatures is needed to authorize delivery of material from storage yard. Fig. 6. Foremen get locomotive crane service with this order; the order slip system avoids verbal requests and allocates charges for crane time.

In the plate shop, as in those of other Pacific Coast yards, there is a notable absence of multiple punches or other heavy equipment which could have come only from Eastern factories. Nevertheless, material is put through at high speed. The plate shop and the angle shop in this yard, with a total area of about 50,000 sq.ft., average almost 12,000 tons of finished metal per month.

The Moore plant has installed its own rivet shop, so as to have an independent rivet supply. The bars for making the rivets are always available from the coast mills. Much of the steel for this yard comes from the Gary plant of the Illinois Steel Co., although shapes and bars are frequently allotted from the San Francisco and Seattle mills of the Pacific Coast Steel Company.

The cost-plus contract under which this yard operated at first has been revoked to put the yard on a lump-sum basis. The latter, with provision for protecting the yard on advances in materials or labor cost, is con-

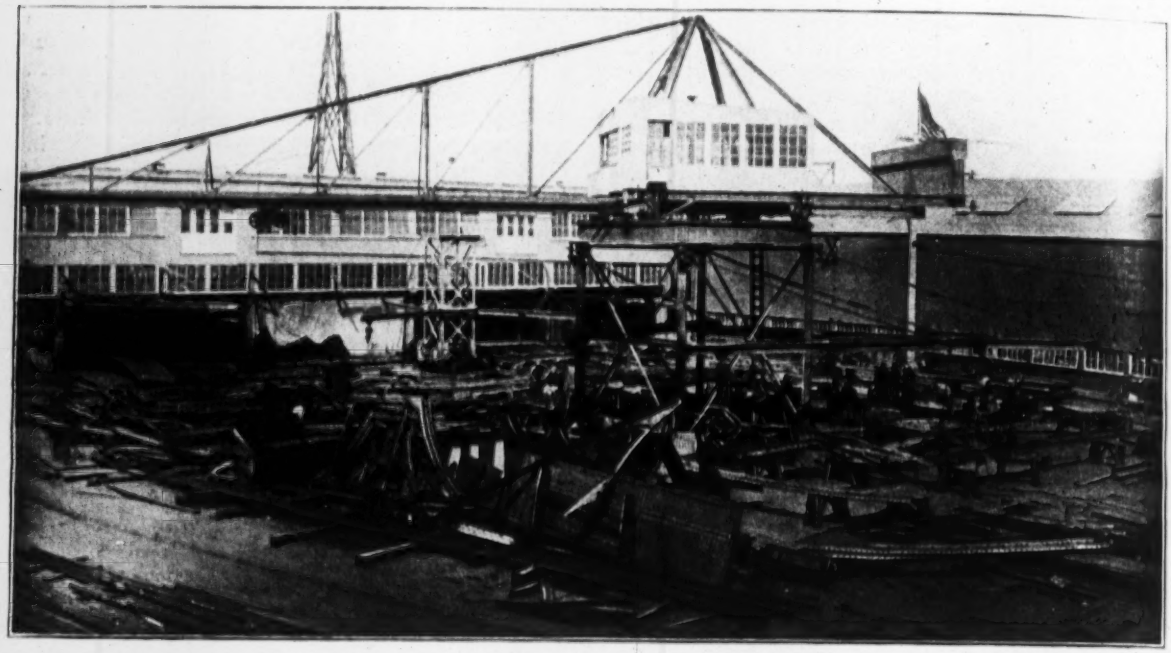


FIG. 7. ASSEMBLY YARD AT HEAD OF WAYS, LOOKING TOWARD PLATE SHOP
The crane is one of the home-made revolving cranes which do much of the yard service at the Moore plant

sidered much more satisfactory. At present the yard is working on 9400-ton refrigerator boats; after their completion twelve 10,000-ton tankers are to be built. The plant employs about 8000 men in all three shifts.

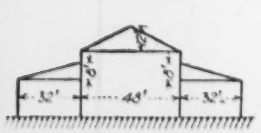
George A. Armes is president and general manager of the Moore Shipbuilding Co., Andrew Moore is first vice-president, and J. A. Moore is second vice-president and general superintendent. Leland S. Rosener, consulting engineer, has laid out the extensions and has designed cranes and other equipment that were built locally.

How Define the Pitch of a Roof?

By R. Fleming
American Bridge Co., New York

THE pitch of a roof is defined, in many a dictionary, handbook and textbook, as the proportion obtained by dividing the height by the span. In most dictionaries of the English language the term is classified as architectural, and the definition is often followed by an explanatory note such as, "If the rafters exceed in length the width of the building the roof is said to be of the Elizabethan or knife-edge pitch; if they are equal to the width the pitch is Gothic; or if two-thirds the width the roof is said to be of a true pitch, or of the Roman pitch; a roof still flatter than this is the Grecian pitch."

The definition is at once seen to be ambiguous in the case of a lean-to or shed roof. If the pitch of the roof over the center aisle is $\frac{1}{4}$, what is the pitch of the roofs over the side aisles, in the accompanying diagram? The inclination of the rafter with the horizontal is sometimes expressed in degrees. But for ordinary slopes this method is cumbersome—a rise of 6 in. to the foot indicates an angle of 26° 33′ 54″. Again, the pitch has been interpreted as the quotient of the rise divided by one-half the span. This is at variance with the commonly accepted definition, but has the same ambiguity. The writer is of the opinion that the term "slope" should be adopted in structural engineering, and suggests the following definition: The slope of a roof is the natural tangent of the inclination with the horizontal, and is best expressed in inches of rise to one horizontal foot. There is no ambiguity in the definition, and the slope is easy to lay out. The mental gymnastics necessary to interpret such sentences as, "the pitch for tar and gravel roofs shall preferably be from $\frac{1}{3\frac{1}{2}}$ to $\frac{1}{2\frac{1}{4}}$," would be avoided. A specified slope of $\frac{3}{4}$ in. to 1 in. per foot would convey at once a picture of what was intended.



TYPICAL ROOF OUTLINE WITH DIMENSIONS

Suggestions and Complaints in Railroad Operation

According to the annual report of Director General W. G. McAdoo, the Bureau of Suggestions and Complaints of the Railroad Administration, established Sept. 3, 1918, received in all 10,424 "initiatory letters" containing 11,666 suggestions, complaints, and commendations. Those commending employees for courtesy and loyalty exceeded the complaints of discourtesy by nearly two to one. In all, some 1328 communications were received, as against 714 letters complaining of individual discourtesy or incompetence. The commendations received have been noted upon the records of the employees and will receive due consideration. In addition, 128 communications commended the railway service rendered by particular lines.

Baltimore Garbage Will Be Made Into Pork

Contractor Will Pay City Three and a Half Times as Much Per Ton as Chicago Top Price for Market Hogs, Thus Eliminating Gambling Risk to Both Parties—Change from Disposal by Reduction

By Walter E. Lee
Water Engineer of Baltimore, Md.

A FEEDING contract for the disposal of garbage was awarded by the City of Baltimore on Dec. 21, 1918, for a period commencing May 1, 1919, and ending Dec. 31, 1923. Under it the contractor will pay the city an annual estimated sum of $31,500. Barging and towing costs will reduce this by $15,000, leaving an annual net return of $16,500.

The writer, in a report of Jan. 28, 1918, to Mayor James H. Preston, recommended that garbage be disposed of by reduction in one central plant; ashes by filling ravines, low marshes and swampy ground along the water front for reclamation of land; and rubbish by incineration of the combustible portions, except the recoverable merchantable articles, in three municipal incinerators. (See *Engineering News-Record* of Mar. 14, 1918, p. 522.)

The history of garbage disposal in Baltimore has been, successively, dumping on the ground, reduction and, finally, feeding. From 1882 until 1901 the garbage was barged to a point six miles below the city by a contractor and there spread over the ground as a farm fertilizer.

A contract for 10 years was awarded, commencing Oct. 20, 1902, at an annual payment to the contractor of $147,300, for the collection, removal and disposal of garbage. An Arnold-Edgerton reduction plant was erected in the heart of the city near the water front, to which the collection carts of the contractor made a direct haul. Complaints of the noncollection of refuse became so numerous, and objections to the odors from the reduction plant were so strong, that the city terminated the contract on Jan. 1, 1908, purchased the collection equipment and reduction plant from the contractor for $372,888, and placed directly under the Commissioner of Street Cleaning the collection and removal of garbage from residences.

A second reduction contract was awarded in 1908 for 10 years, terminating Dec. 31, 1917, at an annual payment to the contractor of approximately $75,000. A new company was organized, and the reduction machinery was leased from the city at an annual rental of $10,000. At the expiration of this contract it was extended for a period of one year, until Dec. 31, 1918, at the request of the city. Under this extension no rental was paid for the use of the city's machinery, so that the cost of disposal amounted in effect to $85,000.

First of Three Calls for Bids in 1918

The first specifications for disposal by reduction, in furtherance of the recommendation of Jan. 28, were advertised in March, and bids were opened Apr. 17, 1918. Proposals were asked on the basis of a lump sum yearly payment to the city under an 11-year contract, the city to deliver to the contractor all garbage produced within the city.

The specifications defined garbage as being every accumulation of animal, fruit or vegetable food waste, containing not more than 5% by weight of other refuse, generated by or resulting from the decay, deterioration, storage, preparation or handling of animal or vegetable matter in any place or at any point where food is prepared for human consumption, including all kitchen and dining-room refuse.

The contractor was required to receive the garbage at the water-front dumping stations provided by the city, and convey it on his own scows and by his own power to the site of the reduction plant.

The specifications provided that the garbage should be handled and disposed of under a "closed" system of reduction, so as to prevent the emission of offensive odors of any kind while being handled, treated or reduced, and that the process, machinery and apparatus be thoroughly sanitary in effect and the plant so conducted as not to cause conditions which would be detrimental to the public health or comfort, or in any way constitute a public nuisance. All gases carrying odors which were produced or resulted from the operation of the process, machinery or equipment used were to be confined and, before being liberated to the atmosphere, were to be thoroughly deodorized. All water flowing from the plant was to be inoffensive, free from nuisance or any matter dangerous to the public health or to the oyster beds in Chesapeake Bay or its tributaries. It was further specified that the city should have the option of purchasing the plant and equipment from the contractor at the expiration of the contract, and that the reduction site should contain not less than five acres, situated on at least one railroad or above high tide on a navigable waterway.

Under this specification a flat offer of 35c. per ton was received from a bidder who proposed to employ the Cobwell process of reduction, but the city failed to secure the approval of the Capital Issues Committee for the necessary stock issue for the erection of a plant of a capacity of 350 tons per day, and the bid was subsequently released.

A second specification was advertised on Oct. 2, with bids to be opened Oct. 16, 1918, under which the city obligated itself to do the same things as in the previous specifications and asked for alternate proposals on disposal by reduction or by feeding. The reduction contract proposed was for 16 years and offered to the prospective bidders, without charge, the use of machinery which the city owned in the existing plant, for reerection and operation in a temporary plant until the end of the war, after which a permanent plant was to be erected. The contract for feeding was for five years. No bids were received under either plan.

A third specification was advertised on Dec. 6, and bids were opened Dec. 18, 1918. Under this specification the city undertook the delivery of garbage from the water-front stations to the contractor's disposal

site, as the city realized that the collection and removal of garbage from its water-front dumping stations was simply an extension of the collection and removal from the residences, and a matter in which the contractor has no primary interest. The towing of garbage was a proper function for the city to undertake, for when any contractor is required to undertake it the public at large is not always satisfied with the way in which the work is done; but when it is done by the city the public always has the proper remedy for getting a quick and adequate response to its complaints of the accumulation and nonremoval of garbage from the water-front stations.

An act of the Maryland legislature prohibits the erection of a garbage-reduction plant within a nine-mile radius of Lazaretto Light, a shore light in Baltimore harbor, and consequently any possible site for such a plant would involve a barging distance of 16 miles from the water-front dumping station in the city and four hours of towing either way.

Alternate proposals were again asked on disposal by reduction or by feeding. The term for reduction was 16 years, and a flat price per ton was requested—with an adjustment, to be stated by the bidder, in cents per ton for every upward or downward fluctuation in the market value of grease from a basic price of 8c. per pound, as the city felt that it should share this risk with the contractor so that all elements of gambling in making a bid should be entirely removed. The term for feeding was five years, commencing May 1, 1919, and bids were requested on an annual flat payment to the city for each ton of garbage delivered to the feeding site.

No bids were received for reduction, and only one bid for feeding. The contractor operating the present reduction plant made no formal offer.

A contract was awarded Dec. 21, 1918, for disposal by feeding. The price to be paid to the city for each ton of garbage delivered is 3½ times the price per pound of live killing hogs on the Chicago market, as determined by averaging the top prices for each month. The scales for weighing the garbage are located at the feeding site, and all garbage is drained before weighing.

Until May 1, 1919, at which time the piggery shall take the full quantity of garbage produced, the city with its own forces will temporarily dispose of its garbage by burying it in shallow trenches 18 in. deep and 5 ft. wide, in which the garbage is placed 12 in. thick and covered with 6 in. of sandy soil. There will be 17,000 lin.ft. required to accommodate this temporary disposal of garbage. The cost of the temporary disposal is 85c. per ton against a former cost of $1.06 per ton under reduction, the towing cost being included in both figures.

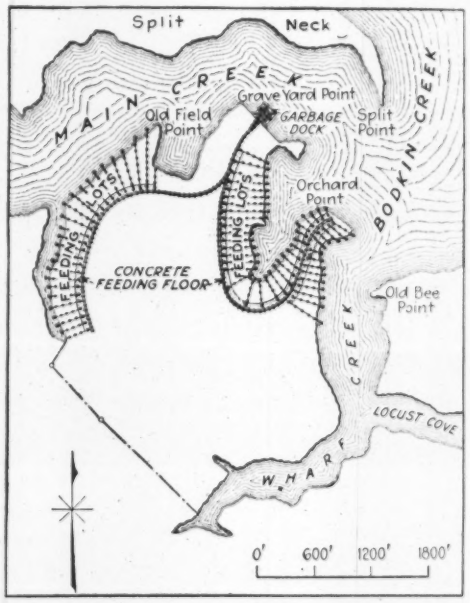
City Delivers Garbage to Feeding Plant

The contractor pays for all household garbage delivered and for those portions of market refuse derived from an animal source, but not for that from a vegetable source or for any packing-house refuse.

The city obligates itself to enforce good primary separation and to deliver the garbage in as fresh a condition as possible to the feeding site, with not less than four deliveries per week in summer and three deliveries per week in winter.

The contractor is given the privilege of using the empty city scows, without charge, on their return trip to the city, for the transportation of the products of the piggery.

The 160-acre farm on which the feeding operations will be conducted is almost level and has sandy soil, insuring good drainage with considerable water through an extensive shore line. Scrub-pine, chestnut and oak timber affords protection from the summer heat. The farm is owned by the city and was purchased at an average price of $140 per acre. It is situated on a point on the opposite side of the tributary of the Chesapeake Bay on which the existing garbage-reduction plant is situated, and this proximity to a plant which has been operating 11 years without any formal complaint or restraint will insure a like freedom for the piggery.



FROM SCOWS GARBAGE WILL BE DELIVERED BY SHORT RAILWAY TO CONCRETE FEEDING FLOOR

The specifications require that the piggery shall be operated subject to the general and local public laws and under the supervision of such veterinarian and sanitary officers of the county and state as have proper jurisdiction. The city will also employ a veterinarian who will have continual supervision and inspection over the work of the piggery. The garbage which is unfit for feeding or not consumed shall be removed from the feeding platforms, which shall be cleaned at least once a day, and shall be disposed of by the contractor through sale or by plowing under the soil.

The area of Baltimore is 80.5 square miles and the estimated population, with the recently annexed territory, is 720,000. The quantity of garbage produced and the seasonal fluctuation are shown in the accompanying tables. (See the following page.)

It is estimated that 15,000 hogs will be required to consume the maximum amount of garbage that is produced during the summer peak; this will probably rep-

TABLE I.—YEARLY COLLECTION OF GARBAGE AND DEAD ANIMALS, IN TONS, AT BALTIMORE, MD., 1908 TO 1918

Year	Garbage Production, Tons	Number of Dead Animals	Estimated Population
1908	54,000	13,754	569,000
1909	46,900	14,637	576,000
1910	44,500	17,790	559,000
1911	48,300	19,792	565,000
1912	49,200	20,498	568,000
1913	54,400	16,561	573,000
1914	59,100	15,993	578,000
1915	61,500	14,459	583,000
1916	62,400	17,419	588,000
1917	62,300	20,178	593,000
1918	51,324	16,464	670,000

TABLE II.—MONTHLY FLUCTUATION IN GARBAGE PRODUCTION AT BALTIMORE FOR 1917 AND 1918

Month	1917, Tons	1918, Tons
January	4,566	3,272
February	3,089	2,081
March	3,594	3,030
April	3,334	3,081
May	4,979	4,570
June	5,475	4,207
July	7,577	5,570
August	7,399	5,267
September	6,886	4,904
October	7,096	6,657
November	4,517	4,392
December	3,749	.....
	62,261	*51,324

*Estimated from eleven months' collection.

resent the largest piggery in the world, and Baltimore will be the largest city of the United States which has adopted this method for its disposal of garbage. Young shoats, vaccinated with cholera serum, will be purchased in the open market and shipped to the feeding station, where approximately 100 animals will be placed in feeding lots 70 x 250 ft. in area.

Garbage will be unloaded from the city's scows at the feeding site by the contractor, by the use of a locomotive crane with a 1-yd. grab bucket. The garbage will be dropped into steel rocker double-side dump cars of 10-yd. capacity, each on an adjacent track, and hauled by an oil-burning locomotive directly down a lane between the feeding lots, as shown by the accompanying map.

The end of the feeding lots adjacent to the railroad will have a monolithic concrete feeding floor, from which the animals will be excluded by wide gates when the garbage is being dumped from the rocker side-dump cars.

When the train has traveled to the full length of its trip, the garbage will be spread on the return trip to the wharf by a spreader from the rear end of the train, after which the gates will be opened and each lot of hogs allowed to enter on the concrete feeding floors.

Disposal of garbage by feeding involves a relatively small capital investment, which can be quickly and almost wholly liquidated at the expiration of the contract, and in this respect differs from all other garbage reduction plants, in which the machinery is of little use for any other purpose and possesses only a scrap value.

Feeding is a reliable method, and one which offers the highest financial returns to a municipality. It is absolutely essential, however, that the responsibility of the bidder be determined beyond the shadow of a doubt, which condition is usually met when there is sufficient training in animal husbandry and practical experience by the bidder in piggeries that have previously been managed successfully.

Road Building Materials Supply Solved by System

Wisconsin County Eliminates Delays and Demurrage—Contractors Selected for Past Record—Cost-Plus-Profit Contract

By Walter J. Driscoll
Assistant Commissioner of Highways, Outagamie County, Wisconsin

Sand, stone and cement are delivered f.o.b. cars at the nearest railway station to all contractors for concrete road work in Outagamie County, Wisconsin. This system has helped greatly in expediting the work, but, to make sure of efficient handling of the contracts, the county highway commission selects the contractors only after careful consideration of their past performances, instead of accepting the lowest bid. Coupled with a special contract insuring a definite profit to the contractors, this arrangement has simplified the wartime difficulties of road construction and assured steady progress in the county's road-construction program. In fact, since the plan has been in operation there has not been a single delay of moment due to nondelivery of materials, and the season's output of finished road has been increased one-half.

Present Outagamie County road practice has developed by steps. The first was education of the citizens to the need of spending money for improved roads. Then, a season's work was undertaken under the old-style itemized-bid contract awarded to the lowest bidder, and the operation of the plan was studied. Revision of the plan to that outlined above was the outcome of this study. Trial of the new plan proved satisfactory, and

OUTAGAMIE COUNTY HIGHWAY COMMISSION

Date 5/2/18

We have this day shipped you

Car Number 71787

Initial C

Point of Shipment *Waukesha, Wisconsin*

Shipped to—Station New London

Weight or No. Cu. Yds. 110,000

Kind of Material Gravel

WAUKESHA LIME & STONE CO.

By RS

NOTE—Please make neat, clear figures.
These cards (a card for each car shipped) must be made out DAILY and NIGHTLY, put in an envelope and MAILED to the Office of the Outagamie County Highway Commission, Court House Appleton, Wisconsin. All cards must reach this office the morning following shipment of cars.

OUTAGAMIE COUNTY HIGHWAY COMMISSION

Name of Road Appleton New London

Car No. 71787 Initial C.N.W.

Kind of Material Gravel Marked Capacity of Car 100,000

Name of Station New London

Date Arrived May 24.

Date Spotted " 25

Date Unloaded " 25

Name of Foreman J. N. Briggs

IMPORTANT NOTICE. MAKE GOOD CLEAR FIGURES. Foreman should fill out this card very accurately and carefully and nightly must put all cards of the cars unloaded this day in envelopes and nightly mail to the office of the County Highway Commissioner, Court House, Appleton, Wis. Failure to properly send in records of each and every car unloaded daily will result in a Penalty of $1.00 assessed against the man neglecting to render such report.

DEALER'S SHIPPING AND FOREMAN'S UNLOADING REPORT CARDS

its details were improved until the practice described hereinafter was adopted.

Outagamie County is the first in the State of Wisconsin in which a proposition to issue bonds for road construction has been carried by popular vote. Ordinarily, the bond issues throughout the state have been small and have been made by action of the county boards. The electors of Outagamie County in the spring of 1916 approved a bond issue of $700,000 for the construction of a county system of concrete highways. More than 60 miles of these roads have been completed at the present time, and so pleased are the people with the results that in the autumn of 1917 an additional bond issue of $272,000 was voted further to extend and complete the system.

During the first season, little actual construction was accomplished. Contracts were let to the lowest bidder, the only requirement being that the contractor must be able to obtain a sufficient and approved bond. By this contract, also, the contractors themselves furnished all construction materials. Actual construction was begun about July 1, and the next thing realized was that it was Oct. 1 and little of the road had been completed. A few of the contractors had done fairly well while some had failed miserably. The result was that some of the main trunk highways were blocked during the winter, and the people began to evince dissatisfaction.

Partial failure of the first season's program prompted reflection, and the winter of 1916-17 was devoted to study of possible reforms. One conclusion appeared inevitable—a radical departure in plan from the usual methods of road construction in Wisconsin was necessary. It was decided that the county must and would exercise a more rigid choice in the selection of contractors who were to carry on future road work, and would also abolish the practice whereby the low bid was the sole basis on which contracts were awarded. Nothing promotes general satisfaction with and creates a favorable sentiment toward road improvement like the execution of a contract in a minimum length of time. Nothing arouses greater dissatisfaction than to have one of the main roads of a community closed to travel for a long period. Consequently, it was decided to confine future business to contractors who had demonstrated their ability to execute their contracts systematically, and who were equipped to execute their work successfully and in the shortest practicable time. The execution of this plan called for a new form of contract.

Contractor Assured of Reasonable Profit

Assurance to the contractor of a reasonable profit was the basis of the contract adopted. All equipment is provided by the contractor, and he gives the work his personal direction for a fixed sum per mile. Labor is hired and paid directly by the contractor, who is reimbursed twice a month by the county. Time is kept by the county inspector. Also, the county commissioner has power to set the maximum wages and to discharge unfit or incompetent workmen.

Attached to and forming a part of the contract is a preliminary estimate by the county commissioner of the labor cost. If the contractor keeps the actual cost below the estimated cost he receives a percentage of the saving. Also, if he permits the actual cost to exceed the estimated cost he pays a percentage of the excess. Both bonus credits and penalty charges are on a sliding scale, so fixed that the contractor's bonus or penalty increases as the saving or the loss increases. The contract for a county road known as the Seymour South highway illustrates the sliding-scale arrangement. Labor cost per mile was estimated at $4298. Below this sum, to $3998 per mile, the contractor's bonus was 20% of the decrease; below $3998 to $3700 it was 40%, and below, $3700 it was 50%. If the cost increased over $4298, the contractor paid 20% of the increase to $4598; 40% of the increase from $4598 to $4896, and 50% of all increase above $4896.

Besides paying all labor costs, the county purchases and delivers all construction materials to the nearest

OUTAGAMIE COUNTY HIGHWAY COMMISSION

CEMENT CARS RECORD

Name of Road _____ Date _____

Contractor _____

We hereby report that this day we have received and unloaded the following cars of cement, consigned to Outagamie County.

Car No.	Initial	No. of Bbls.

Signed _____

IMPORTANT NOTE.—Contractors must mail in these cards nightly of the day cars are unloaded. Failure to receive these cards promptly results in the loss to the County of discount for prompt payment from the Cement Companies, so therefore discount losses to the County, through Contractors failure to nightly fill in and return the correct car records, will be charged against said contractor or dealer and deducted from his contract.

CONTRACTOR USES THIS POSTAL-CARD REPORT FOR CEMENT UNLOADED

railway station. Experience with the first season's contracts indicated that delay in the supply of materials had been a prime cause of hindrance. All materials had to be shipped in by railway from plants and quarries situated from 50 to 100 miles from the work. Certain contractors seemed able to obtain materials—at times even more than they required to meet current consumption—and would accumulate stocks, while other important jobs would be shut down for lack of one kind or all kinds of materials. For example, important jobs on the outskirts of the City of Appleton, which is the county seat, were tied up for lack of material, while less essential roads, from the standpoint of service to the whole county, were receiving more material than was needed to maintain progress. Coördination of materials supply, considering the road work as a whole, was lacking. Obviously, the remedy was to be found in selecting a single head who would direct and control the supply and distribution of materials for all the road work of the county. Naturally, the most appropriate head was the county road commissioner.

System Eliminates Delays

For two years the county has furnished contractors with all cement, sand and gravel f.o.b. cars at the nearest railway station. The contractor hauls the material to the work and includes this expense in the labor cost. This plan has its disadvantages, but its success, on the whole, has been great. During the period in which the plan has been in operation, there has not been a single delay of moment in the supply of material,

and the season's work has been increased 50%. Contractors were at first a little skeptical, perhaps, of the innovation, but today it is doubtful that a single contractor would vote to return to the old plan.

Success in supplying and distributing materials by the county has been the result of the system. Each company from which material is bought sends to the county commissioner daily a notification card for each car shipped. This card is of a form devised and furnished by the county, so that there may be uniformity of reports. When the notification card is received it is placed in the live-card file. The card bears the car initials and numbers, kind of materials, weight, destination of car, etc., and is filed under the name of the road on which the materials are to be used and the name of the station to which the car is shipped. For each car an unloading report card is made out and sent to county headquarters by the foreman at the point of unloading. This card differs in color from the notification card and bears car initials and number, weight, date received, date spotted and date unloaded. The form of these cards is shown in an illustration. When the latter card is received from the foreman, it is checked with the corresponding notification card and inserted behind it in the live-card file. When the freight bill is received it is checked with the cards on file, and then the three are indexed and filed in the permanent file under the job name. This gives for quick reference a history of every car of materials. A special postal-card report form is provided, as shown in another illustration, for the contractor to use in reporting cement unloaded.

Report Cards Alone Not Enough

Report cards, however well devised, are alone not sufficient to control shipments. Regularity in making out and forwarding the cards must be assured. To make certain that the unloading foremen do not fail to make reports promptly and regularly, they are first supplied with stamped and addressed envelopes. Whether they have to report one car or a dozen, they must mail the report the night when cars are received, and, if they do not, a penalty is imposed. Once a foreman thus learns that his instructions mean what they say, little trouble is experienced in getting prompt reports—and promptness is essential if materials are to be routed and distributed accurately.

Each morning, at a certain time, the agent of each station at which shipments arrive is called by telephone, and from him is obtained a list of the loaded cars on track at his station. Having these lists and the card reports previously mentioned, and having also the report of the inspector on each job for the previous day, as to how much material was received and how much was used, the companies supplying materials are called by telephone, and orders are given for destination and routing of the day's shipments. Also, means can be taken if necessary to divert cars in transit to new destinations. If one job happens to be shut down, the material is diverted to that other job where it is most needed. If trucks break down or cars pile up, or for any reason it is apparent that material cannot be handled at one point, it is diverted to another point where it can be handled.

Recapitulated, the force employed comprises the assistant highway commissioner, who purchases and directs distribution; the county road inspectors, who report daily the amounts of materials received and used on the jobs; the unloading foremen, who report daily on the cars received and unloaded, and one office clerk. One-half of the assistant commissioner's salary and expenses is charged to materials management, since half his time is devoted to general supervision and inspection of construction. All of the office clerk's time is charged. The county inspectors report on materials as a part of their regular duties. Since they would be employed and receive the same pay whether or not the county supplied materials, no charge is made for their services. Also, since the unloading foremen are the contractor's regular foremen and the daily report which they make is incidental to their regular work, no charge is made against materials management for their services.

Based on the past season's work, from May 1 to Sept. 1, inclusive, during which period there were used in construction 1410 carloads of sand and gravel and 210 carloads of cement, the charges for materials management were:

Assistant commissioner (one-half time)	$600.00
Office clerk (full time)	320.00
Telephone charges	94.90
Printing, stationery, postage, etc.	102.90
Total	$1117.80

These figures are the true and actual records, and may be verified by the accounts and vouchers on file in the office of the county highway commissioner. They permit the following deductions:

Number of cars handled	1620
Average cost per car, cents	69
Number of cars sand and gravel	1410
Cost per car (1410 x 69c.)	$972.90
Contents of cars, cubic yards	54,990
Cost per cubic yard, cents	1.77
Carloads cement handled	210
Cost per car (210 x 69c.)	$144.90
Barrels of cement	42,100
Cost per barrel, cents	0.344

Briefly, then, by the plan described, the county has eliminated demurrage and kept cars moving. In two years there has been no delay in construction due to lack of materials. The cost has been moderate.

Cement Production Falls Off

Statistics and estimates of the production of portland cement in 1918, compiled under the direction of Ernest F. Burchard, of the United States Geological Survey, Department of the Interior, shows a marked decrease in the total output; in fact, the output was the lowest since 1909. The estimated shipments of portland cement in 1918 amounted to 71,645,000 bbl., valued at $113,910,000, compared with 90,703,474 bbl., valued at $122,775,088, in 1917, a decrease in quantity of 21% and in value of 7.2 per cent. The estimated production in 1918 was 71,632,000 bbl., compared with 92,814,202 bbl., in 1917, a decrease of 22.8%. The stocks at the mills increased from 10,462,822 bbl. in 1917 to about 10,594,000 bbl. in 1918, or 1.3 per cent. The exports of hydraulic cement from the United States for the first 11 months of 1918 amounted to 2,025,178 bbl., valued at $5,257,285, or $2.59 per barrel. The exports for the whole year 1917 were 2,586,215 bbl., valued at $5,328,536, or $2.06 per barrel. The export trade also therefore fell short of that for 1917.

The Economic Duties of the Engineer

By W. R. Ingalls
Editor, "Engineering and Mining Journal," New York

In the presidential address before the Mining and Metallurgical Society of America, Jan. 14, 1919, W. R. Ingalls presented a discussion of the present duties of engineers in relation to the economic problems of the immediate future. The portions of this address which concern civil engineers most directly are here reproduced. After emphasizing the great fundamental economic laws, he analyzes the distribution of wealth in this country and asserts that labor gets what is left after taxes, rent, interest and profits have been paid, and that "what it gets is what it produces." Hence follow the necessity and value of greater production, especially in view of the increased alertness and intelligence being applied to methods of production in Europe. The need for promotion of human welfare by the engineer, and his obligations in this direction, are insisted upon. Of the trinity of production—labor, capital and talent—Mr. Ingalls asks who among the talented are so eminent as the engineer, and closes with an indictment of engineering societies and a strong appeal for an awakening to economic duty.—Editor.

SUPERIOR to all industrial and political principles are economic laws, for it is those laws, which are laws of nature, that create and determine principles and practices. One of the greatest of economic laws is that of the survival of the fittest, which exhibits itself in competition, and from that is derived the classic economic doctrine that labor is the residual claimant upon the produce of industry. After the shares of the state, the landlord, the capitalist, and the *entrepreneur* have been deducted, all the rest goes to labor, and here is what is mystifying to many—to wit, rent, interest, and profits are limited by competition, and of them the laborer can get neither the share of the landlord nor of the *entrepreneur* by any economic means, while, as for interest, the residual claimant is benefited by every payment on account of capital used in the production of wealth, and is better off when a high rate of interest is being paid than when a low rate is paid. We may apply the principles to the concrete case of the United States.

The wealth of the United States at the end of 1916 was estimated at about $250,000,000,000. The production of things was about $50,000,000,000. These are very rough figures, as they are bound to be. Estimates relating to this subject vary considerably. I have mentioned the highest that I have seen. There is reason to suppose that the higher figures are more nearly correct than the lower. Anyhow, I am going to use the highest only to give an approximate idea of proportions. This was before the United States entered the war, and, according to the United States Bureau of Labor, we had 40,000,000 workers. Let us assume that rent, interest, and profits averaged 4% of the wealth of the nation, which would hardly be extravagant. That would account for $10,000,000,000 out of the total product, leaving $40,000,000,000 for labor, or $1000 per worker. Two million railway workers and 250,000 iron and steel workmen received about that sum. Those figures are specific expressions of two whole industries. The workmen in some other industries earned more; in some they earned less.

That labor does not get increased wages at the expense of capital (unless capital be confiscated, in which event the increased wages will not long endure) is illustrated by the experience with the railways in Great Britain and America. The Governments guaranteed the bond and stock holders their average return for a series of pre-war years. In the United States this was $1,000,000,000 per annum, or just about 5% on the capital as reported by the Interstate Commerce Commission. The increase of $800,000,000 in wages has been paid by the public in higher freight and passenger rates. To have left the roads in private hands, compelling them to pay higher wages without permission to make higher charges, would have resulted, first, in impaired service and finally in the state having to take over the lines and supply the deficit in order to have any service at all, just as has happened with some of the street-railway lines in Massachusetts. Thus, what is virtual confiscation aids the wage earner only slightly and only temporarily.

But, apart from confiscation, the winning of increased wages by one group of labor is obtained only at the expense of other groups. The inequality in the distribution of wealth is not between the capitalist and the laborer, but rather is it among laborers themselves. There is ample ground for the surmise that the professional, clerical, shop-tending, and similar classes, and the salaried classes generally, have suffered especially at the hands of the railway operators, mechanics, artisans, builders, and miners, but the farmers and the factory folk have not been immune.

I am not going to enter upon any fine analysis of the very rough statistical data that I have given, and shall point out merely that after the state, the landlord, the capitalist and the *entrepreneur* have got their taxes, rent, interest and profits, of which the last three are severely limited by competition, labor gets all the rest, and what it gets is what it produces. The only way it can get more is to produce more.

It is unfortunate that the only way of expressing production is in terms of money. If it were possible to express it in terms of goods, there would be less misunderstanding. However, it is clear that if the total goods and the total population remained the same, it would not matter if the money value of the goods

fell from $50,000,000,000 to $30,000,000,000—i.e., it would not matter at all if money wages fell from $1000 per annum to $600, as, indeed, they would fall inevitably. On the other hand, if commodity prices remained the same, and the value of products should rise from $30,000,000,000 to $50,000,000,000, labor would get so much more, for it would be producing more goods. This is the only way that the war scale of wages can be maintained, and it is a problem of capital, labor and talent to coöperate in accomplishing it, for only by cooperation can it be done.

Classic Economic Doctrine

This is no preaching of capitalism as commonly understood, but is simply classic and proved economic doctrine. The workman who wastes time and material, the farmer who lets himself be led astray by foolish agrarian policies, the small miner who is similarly misled, the manufacturer and the railway company which fail to adopt efficient methods, the interests large and small which create monopolies or enter into agreements to exact noncompetitive prices—all of these are counteragents to progress in human welfare, although in varying degrees. Probably, on the whole, there is more intelligence among the great corporations than there is among the labor unions, and a better understanding of economic principles, but there are some labor unions whose leadership is bright and some corporations whose management is stupid, while of both there are many that are only mediocre. My thesis is rather that the only way whereby the condition of the mass of the people can be improved is for it to produce more, and the loss of capital and life that has been suffered during the last 4½ years makes it particularly essential now to give attention to increased production, to accomplish which we shall undoubtedly need to develop new systems and new methods. This is what I mean by the necessity for reorganization, rather than readjustment, after the war. And it is in such reorganization that the engineer must play a great part. England is already making her plans, and unless we are careful she will get the start of us. Thus, I recently noted the following paragraph in a letter from an observant American traveling abroad:

"England is knitting together for work. The directors of capital and the organizers of labor were never more together. There have been no strikes in England against capital, only against Government wages or failure of Government to equalize matters as between war bonuses and high cost of living. England is studying efficiency and is preparing for the overseas competition of the future. Forty-six English factories, without trade union or labor opposition, have adopted scientific management, but no stop-watch can be used in any factory controlled by the United States Government, nor is it allowed by the labor unions to make studies in time or motion, or to compile records to promote individual efficiency."

Now, more than ever, should labor in this country be taught that its real interest is to produce more, which is to earn more, and employers should not attempt to diminish labor's residual claim by abolishing competition among themselves or artificially enhancing profits by other means. And just as it is the interest of labor to earn the maximum, so is it the duty of the employer, which means that he should ever be alert to improve his methods of production. Wide differences of plant efficiency, administration, etc., are really the inspiration of social unrest among workers, rather than conditions that are intentionally designed to be evil. The social reformer, who does not understand production, is a far less important person in the promotion of human welfare than the engineer, who does.

America and Great Britain may be in no danger of either political or industrial socialism—the results of the recent elections in each country are reassuring as to that—but, nevertheless, some of the virus has got into us, and, anyhow, our affairs are bound to be affected by the back-wash from the revolutions in Russia and in Germany. Those adversities come on top of the direct destruction by the war in the countries that have preserved their stability. You may mark my words that the engineer is going to have from now on such obligations as he never had before. How he will live up to them remains to be seen. Certainly he will live up to them best if he knows what they be. I can do no more than state them as I see them. Perhaps I see only a few of them. Without any doubt I fail to see all of them.

Study Sound Economic Doctrine

First of all, what I see is that the engineer should saturate himself with sound economic doctrine. This is just as much the basis of his professional work as are the sciences of physics and chemistry; and the fundamental laws of economics are just as immutable as are the laws of gravitation and indestructibility of matter. The engineer-economist cannot possibly be a socialist, or a semi-socialist, nor even an industrial democrat; for it is his business to produce, and socialistic tenets do not tend toward production.

The engineer must be not only a counteragent against the destructiveness of the proletariat, but also must he direct himself against the sluggishness of tortoise-like capitalists. One of the cardinal principles of American engineering during the last 20 years has been the exchange of information and the promotion of publicity about everything—technical processes, business relations, corporate affairs. We have seen America forge ahead largely owing to the absorption of this idea, while Great Britain lagged behind and almost went asleep at the switch. She is wide awake now. Let nobody forget it. But we ourselves have got to go further in publicity than we have gone heretofore. Publicity has been a favorite word among us, especially among mining engineers, who have created more openness in the affairs of their profession and their corporations than exists anywhere else. In reading one of Hobson's treatises not long ago I found a word that struck me more emphatically than publicity. He spoke about transparency, and said that "Perfect transparency of industrial operations, perfect fluidity of labor and of wealth, would effect incalculably great economies in the production of commercial wealth." And he said further: "No fact bearing on prices, wages, profits, methods of production, etc., merely concerns a single firm or a single body of workers." The more you think about that the more will you be impressed by its truth and its merit. Further

effort toward perfecting the transparency of industry is, then, another of the economic duties of the engineer for the promotion of the production of wealth.

Must Harmonize Labor and Capital

I have just quoted from Hobson's work on the "Evolution of Modern Capitalism." In an addendum to that book, written in August, 1916, he outlined post-war economic problems in a way that was prophetic. Let me quote one paragraph: "After the war, the task of economic reconstruction will compel the adoption of bolder experiments, both in public and private enterprise, than had hitherto been thought possible. To realize the enlarged productivity, more pacific coöperation between capital and labor, employer and employed, is a first essential. The immediate peril of an economic situation in which labor seems liable to a sudden fall of wage from the artificially inflated war level will evoke conscious efforts to find ways of harmonizing the interests of capital and labor. The issue is one of devising adequate and reliable stimuli to draw from the workers a larger and more regular output of productive energy, a greater willingness to adopt and apply new mechanical and business methods, and, in general, to coöperate more effectively with the other factors of production."

There was real vision in that forecast of 30 months ago. I may be captious in my criticism of it for its reference to capital and labor, which antithetical representation of two parties alone is always irritating to me. Even some of the socialistic writers recognized many years ago that it was necessary to consider the talented classes as well as the laboring and capitalistic; and recently Lenine and Trotzky, appreciating that the confiscation of capitalistic wealth would not reduce Russia to a dead level of equality so long as they allowed talent to exist, logically began the massacre of the intelligentsia. Labor, capital and talent are a trinity, which one of our rough-and-ready philosophers not long ago represented as a three-legged stool. Among the talented, who are so eminent as the engineers, and whose is more clearly the duty of devising the new stimuli that must be provided?

But while devising stimuli for the workmen let us not forget the need for opening the eyes of the employer to his own defects, and I do not mean defects in his human relations, but rather his economic defects. For an employer may be a generous and lovable captain, whom those working for him may affectionately call "the old man," and yet he may be their worst enemy, an economic impediment, owing to his ignorance and backwardness. Just as there is a class of no-rent lands which determine the price of agricultural produce, so is there a class of no-profit employers who determine the rate of wages.

Sometimes we see the backward manufacturer stirred to new and better things by the threat of imminent extinction through the advent of a new competitive process. Thus, about 20 years ago the contact process of making sulphuric acid promised to displace the classic chamber process, and abolish millions of dollars invested in plant, but the chamber-process men bestirred themselves, improved their practice, and held their own. Right now we see in the electrolytic process of zinc extraction a dire threat against the distillers, and the probable dislodgment of some of them. There will not be an extinction of them as a class, but there will be a case of the survival of the fittest; and those will be the fittest who first improve their practices in ways for which there is room, but which they will not take until necessity drives, necessity in this case being the danger of losing all of their capital tied up in plant.

We have seen how in antebellum days Great Britain practically lost important metallurgical industries, such as zinc smelting and copper smelting, in which she was once preëminent, and we see her now keenly studying and introducing improvements that will rejuvenate her and not unlikely put her ahead of us if we do not look out. Similarly in France, Spain, and other countries, where important steps are already being taken. But few people here appreciate the alertness and intelligence with which the Europeans are entering upon a new program, for the simple reason that they know they have got to do it. It is one of the immediate economic duties of American engineers to see that our own industries do not become blind to the reorganization that is being started elsewhere and ought also to be considered here. I am not now thinking in terms of individual enterprises, many of which may be, and doubtless are, very efficient; but rather am I thinking of industries as a whole.

And just as we must think of industries as a whole, so also must engineers think and act as a whole. The individual, no matter how superior he may be, cannot alone make very much of an impression. Indeed, his influence may be greater abroad than at home, and may be more to the advantage of foreign people than his own if he be unsupported by a body of colleagues at home, as witness the influence of Orville and Wilbur Wright in aëronautics.

Indictment of Engineering Societies

I think it is an indictment of the engineering societies of this country that they have made no general efforts for the advancement of economic conditions. Their meetings have been pleasant social functions, the benefit of which is not to be decried. Their printed transactions have been the repositories of valuable technical papers, which are useful for reference and guidance. But in their practical indications, in their practical push toward better things, they have been insignificant in comparison with the splendid efforts of the American engineering press, respecting which we may proudly say, *"Ne plus ultra."* Pray forgive any impropriety in my expressing this, for of course I have not in mind my own trifling part in what hundreds of papers have done with the coöperation of the industries and professions that they represent.

The Mining and Metallurgical Society of America is one of the few professional organizations that have aimed to improve economic conditions by active concerted pressure representing the consensus of professional opinion. Its efforts have naturally been confined to its own industry. In spite of its small membership, which smallness is, after all, inconsequential, so long as there is the right quality of membership, this society undeniably did most in recent years to improve the transparency of the mining industry. With equal assurance may it claim the credit of giving the impetus to the movement for greater

safety for miners. And also may it claim the crystallizing of the movement for a reform of our archaic mining laws upon new lines, as to which the mining industry is in almost unanimous agreement, the actual drafting of the new legislation having been delayed by the advent of the war. It is exactly such kind of work, now with regard to some broad economic principle, now with regard to some plans for new legislation, and at other times, at the present time, with regard to purely technical questions such as the status and particular problems of the copper, lead, zinc, or iron mining industries, that mining and metallurgical engineers must act unitedly through a body like this, if we are going to achieve the right reorganization in this country. And what we do in our particular field, so must the civil, mechanical, and electrical engineers do in theirs.

Engineers' Services in the War

With the entry of the United States into the war, the engineers of the country, like everybody else, enthusiastically offered their services to the Government. I think that the engineers were particularly eager, for they knew from the previous experience of our allies that it was an engineering war. Our own members, and those of other societies, and engineers generally, entered the services and undertook duties at Washington and elsewhere in great numbers. Now, far be it from my thought to minimize their accomplishments. The job was done, the war was won, sooner than we expected and more victoriously than anybody ventured to prophesy; and that was the principal thing. We performed some marvelous engineering feats in building cantonments, in repairing the German ships, in organizing and equipping a great army and transporting it to France, in building shipyards and ships, in feeding our allies and supplying them with materials. I cannot hope to enumerate all the praiseworthy things that we did, largely through the instrumentality of our engineers. Yet I cannot overlook that according to General Pershing's official report, made after the armistice, his armies had fought with French guns, British tanks, and French and British airplanes, although 19 months had elapsed since the United States entered the war. Nor can I forget the coal famine, and other industrial troubles in this country, and consider that the engineers of the country did all that they might. It was not their fault that they did not. They wanted to do everything in the best way, anyhow to give the best that was in themselves. The engineering societies did loyal and effective work in so far as they were asked or permitted. Yet is seems to me that the delay in starting shipbuilding, the subsequent airplane fiasco, the mess about making the 75-millimeter guns, and some mix-ups in our own industry, show that our engineering bodies did not exercise the pressure toward prompt and successful accomplishment that they might have done. Sometimes, when we knew that things were going wrong, we let ourselves be swayed by emotions and by condonations that anyone of us would have regarded as short of his duty to an individual client.

The wicked war is now ended, thank God, and the hurly-burly of doing thinks quickly, without counting cost, is past. We are entering upon an era not merely of reconstruction or readjustment, but of reorganization, in which it will be many years before we shall be able to form much of an idea of what the result is going to be. There is every probability that engineers are going to be called upon to play a great part in this, and now, fortunately, they will be able to give more deliberate consideration to the study of problems and the formulation of plans than they could during the war. They will have to work individually and also concertedly through professional bodies like this. If they fail to do so, they will be derelict not only in their economic duty, but also in their duty as citizens of the Great Republic, whose welfare must not be permitted to suffer during the coming period of competition and elevation among our friends and rivals.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Association Seeks Better Pay for Railway Engineers

In its campaign for fair play for railway technical engineers, the American Association of Engineers has issued a circular giving schedules of monthly pay recommended by three leading chief engineers as follows:

	A	B	C
Division engineer	$300 to $400	$325 to $350	$320
Assistant engineer	250 to 300	224 to 240	225
Instrumentman	175 to 200	$175	190
Rodman	75 to 90	145	125
Tapeman	60 to 75	120	90
Draftsman	130 to 175	150 to 200	175
Chief draftsman	200 to 250	250	250

This circular also announces a plan for financing the campaign, by setting aside half the receipts from new railway members during January, and by soliciting subscriptions from present members and engineers who are not members. This fund will be used to make a study of the wages paid to technical engineers in railway service, and to present the results to the Board of Wages and Working Conditions of the United States Railroad Administration.

Participator Gets Greatest Benefit From Serving Societies

That the benefit of society work and the return is of most value to the member who participates, is one of the points too many young engineers are inclined to forget. The return is prompt and positive, said Charles B. Burdick, president of the Western Society of Engineers, at the recent annual meeting. His further views along the same line follow:

"He educates himself in presenting his message to others. It is no doubt true generally that none receives a greater benefit from an engineering paper than the man who prepares it. Those who miss the opportunity thus to benefit from the society lose one of its chief advantages.

"But we are not all benefited to an equal degree, nor is the gain equal from year to year. Some will reach

a time when perhaps their duties are of such executive nature that they get out of touch with pure engineering, and some may feel that society work is too great a burden, and the *unthinking* may reach the point where he questions its value because he personally does not feel the need of it. If so, then it is well to remember that the society represents all grades of membership, that there are others less fortunate who need to keep abreast of the engineering times, and who need the acquaintance that comes from contact in the work of the society. From the standpoint of earning capacity, the engineer has no better asset than to be well and favorably known among engineers. This is true regardless of the engineer's position, whether he is engaged in purely scientific or commercial endeavor, whether depending on fees for a livelihood or working for a small salary."

Mr. Burdick's positive statements with reference to compensation will cheer the young man. He said, "I believe the society is justified in proper efforts looking toward better compensation for engineers, but anything savoring of trade unionism would be the most positive detriment. The engineer's best stock in trade is his absolute loyalty to the job. It opens fields of unlimited possibilities that would be closed, and properly so, by any evidence of a tendency to coerce, or to standardize service.

"But there are many things we *can* do that would be in the interest of the individual engineer and the public; no doubt more than we have done in the past. We can use our influence to see that technical men are appointed to public positions requiring technical skill, and that remuneration is provided sufficient to attract men of capability. We can help to educate the public to better appreciation of engineering and the necessity for adequate compensation. We can increase our facilities for solving the question of unemployment, particularly among our members."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Ratio of Tensile to Compressive Unit Stress Should Be Increased

Sir—I have noted with interest Dr. Waddell's suggestion, in your issue of Jan. 16, p. 155, that riveted truss bridges of 100-ft. span be tested by the Bureau of Standards at Washington. Such tests should be an advance over the present methods of testing columns and tension members, and would add to our knowledge. A very great advance was made in our knowledge when full-size tests replaced specimen tests.

The writer believes, however, that the tendency in the American Railway Engineering Association to alter the relation that has existed between compression and tension working stresses is rational and in the right direction. Column tests made some years ago showed that the same proportion existed between the elastic limits and ultimates of full-sized columns, and of full-sized tension members.

Engineers can hardly be said to be hasty in altering the working stresses. The writer believes that safe working stresses in bridge columns could be represented by the formula $14{,}000 - 0.272\,(l/r)^2$, corresponding to safe working stresses in tension of 20,000 pounds per square inch.

There is no denying that if this new tendency is correct much metal has been wasted in tension members of bridges. A similar reasoning leads one to believe that much metal has been wasted in tension flanges of girders—for, as Dr. Waddell points out, consistency requires lower unit stresses in compression flanges than are now used, or higher unit stresses in tension flanges. It would seem that the latter course is safe. The writer further believes that present specifications require altogether too many web stiffeners.

A series of tests of riveted truss bridges would certainly settle the question of relative compression and tension stresses. It would add much to our knowledge of the behavior of members in actual structures.

ROBERTS S. FOULDS.
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Rapid-Transit Construction Should Be Separated From Regulation

Sir—I have seen little or no comment, in either *Engineering News-Record* or any other paper or magazine, relative to the very drastic and pertinent recommendations made by Governor Smith in his message to the legislature of New York, on Jan. 1, 1919, concerning the reorganization of the Public Service Commissions of the state. It does not appear that this matter is receiving the attention that its importance to the city and state demands.

The Governor proposes to take away from the Public Service Commission of the First District all control and supervision over rapid-transit construction work in New York City, and to place it under the control and direction of a rapid transit commissioner, who would devote his entire time to the completion of the construction work. In this recommendation the Governor goes to the very heart of the trouble that has afflicted rapid-transit work from its very inception. If, in the beginning of the work on the dual systems, a single commissioner with full powers had been put in charge, it is more than probable that—even including delays incident to the war—all work under the dual system contracts would have been completed months ago.

With a commission composed of five members, all with equal powers, responsible collectively but not individually, it could easily have been foreseen that delays in carrying out the work would follow inevitably. With such a commission, whose personnel was continually changing in whole or in part almost yearly—new commissioners coming in with new ideas—it was difficult if not impossible to formulate any policy that was likely to stand for any length of time. This has led to end-

less delays and much confusion in the rapid execution of the work.

In addition to its supervision of rapid-transit construction work the Public Service Commission has its primary function to perform, the regulation of public utilities. Therefore, its full time and energy could not be devoted to the construction work. The commission has been handicapped from the very beginning by the method provided by law for handling the work; the method and not the commission is mainly at fault. A great deal of the criticism that has been raised against the commission, on account of the delays in completing rapid-transit construction work, is in many instances both unfair and unjust; it seems to be conceded that the commissioners generally have endeavored to carry out the work both honestly and faithfully; the failure of the commission to function properly must to a very large extent be set down to the mistake that was made in providing a method of supervision that was both cumbersome and inefficient. This appears to be the opinion of most of those who have given the matter much thought.

One of the great object lessons of the war has been that, if results are to be obtained along any line of endeavor, responsibility must be fixed by giving to a single qualified executive full powers and purisdiction. This was demonstrated also in the construction of the Panama Canal; if General Goethals had not had full authority in connection with all construction, it is more than probable that the canal would not be finished yet. The proposal of the Governor to place rapid-transit construction work in the hands of a single commissioner, with full power and responsibility, is sound and is dictated by the hard-learned lessons of past experience.

To engineers especially, and to all those who are interested in the early completion of the rapid transit systems in this city, this is a matter of vital importance, and it would seem that every effort should be made by engineers and the public generally to aid the Governor in obtaining the necessary legislation.

If the statements in the public press are to be believed, it is the intention of the Governor to appoint an engineer as rapid-transit construction commissioner, if the necessary legislation is enacted. This is also to be commended as sound policy and very essential if the work is to be brought to rapid completion.

The Governor has further recommended other radical changes in the organization of the Public Service Commissions of the First and Second Districts. He proposes to do away with the present five-headed commissions and to substitute therefore, in each district, a single commissioner with four deputies; this appears also to be a step in the right direction, as it will not only fix responsibility on a single individual, but will tend toward increased efficiency.

If the commissions are organized along the lines proposed, and the public service commission act is amended so that power is given to the commissioner to enforce his orders without undue delay, much of the discontent and dissatisfaction now existing will be very materially modified.

The legislation proposed by the Governor appears to be so necessary and essential to the welfare of the public generally that I believe the greatest publicity should be given the matter. I have therefore taken this opportunity of writing you at length. ALFRED LUDWIG.

103 West 54th St., New York.

More Comment on Engineers' Salaries

Sir—The letter of Professor Barnes in your issue of Dec. 26, under the caption, "Why Offer Such Low Government Salaries?" reminds me of a recent request addressed to the writer by the wife of a mechanic here in Toledo. She said:

"Please secure a job for my husband at the Air Nitrate plant which will pay as much as the night engineers are receiving there; viz., $9.15 per night, or nearly $300.00 per month, as they are on duty every night."

It looks as though Uncle Sam were penalizing the man who possessed both theoretical and practical knowledge, and favoring him whose training is strictly practical. I wonder why this is so? W. J. SHERMAN,

Toledo, Ohio. Consulting Engineer.

Sir—I have read with interest the criticisms which have recently appeared in your columns of the low remuneration earned by civil engineers in America, and as a member of the profession, not an American, but merely a visitor, it would seem to me these criticisms are entirely justified.

I recall an interesting incident which occurred on my first arrival in this country to complete my technical education—a conversation I had with a man who was painting my room. He inquired what course I was studying, and on my replying, "Civil engineering," it was evident that he regarded me as either an ass or an imbecile. Then he asked me if I intended to settle in America. I replied in the negative, on which he remarked it was a good thing, as, if I did, I should starve. He cited the harrowing experience of one of his nephews who had striven hard for a technical education, had been graduated as a civil engineer, and, after working for the munificent salary of $10 a week for a couple of years—this was before the war—had thrown the calling over in disgust and turned to something else.

There is something radically wrong somewhere with the organization of engineers, and members of the profession must wake up and help themselves, since it is waiting for the millennium to expect others to help them. Is it not a disgrace that those who are supposed to possess organizing ability in a peculiar degree should evince so little of this talent in the protection of their own interests? If civil engineering societies serve no purpose other than to provide opportunities for their members to read voluminous papers on professional subjects, then it is time for engineers in America to decide whether they do not fall short of their proper function.

Engineers must be brought to realize that in furthering their pecuniary interests they are doing something neither unprofessional nor derogatory to their self-respect as individuals. Staunch coöperation secured for the medical fraternity their present recognized status, and only similar effort on the part of engineers can

better a state of affairs which all of the calling, I think, are agreed is nothing short of disgraceful. As a first step in this direction, it would be a good thing if engineers agreed to admit to membership only those able to furnish satisfactory evidence of professional competency, examinations to be instituted to determine the latter qualification. The second step would be for engineers to decide precisely what constitutes civil engineering, to press for the enactment of legislation making compulsory the employment of civil engineers in the supervision of all activities falling within this definition, and to refuse to work with or employ anyone not properly qualified as a civil engineer. A. E. GOLDING.

New Haven, Conn.

Sir—In *Engineering News-Record* of Dec. 26, p. 1192, I noticed a letter from Prof. A. F. Barnes, dean of engineering, New Mexico College, discussing the low rates of pay offered to draftsmen by the Navy Department. He also quotes from a civil service announcement that "the department is finding some difficulty in obtaining, for the rates of pay it has to offer, men with the qualifications necessary to meet its requirements." He also discusses further the low rates of pay offered to engineers in general by the Government departments.

The answer to the Navy Department statement may be found in the decision by the Shipbuilding Labor Adjustment Board of Oct. 1, 1918, in Section XVII of which rates of pay for draftsmen are authorized. The decision is quoted below:

"In response to the request of the Navy Department and the Emergency Fleet Corporation, of representatives of the employees affected, and of many of the shipbuilding companies, we have held hearings and made a careful study of the compensation and privileges enjoyed by draftsmen, with a view to standardizing these conditions in the shipyards under our jurisdiction. On the basis of this study we direct that in all shipyards building vessels under direct contract with the Navy Department, or the Emergency Fleet Corporation, the compensation, hours and conditions of employment of draftsmen and copyists conform to the following regulations, to be made effective in such shipyards with the pay periods beginning on Oct. 1, 1918, or immediately thereafter.

"First: Draftsmen and copyists are to be subdivided into the following defined classes, and are to receive the compensation indicated:

"*Charge Man*—Man who is in responsible charge of the drafting work on one or more ships and who is supervising its execution. Must have had five years' experience in marine drafting, or be a graduate of a technical school in the course in engineering or architecture, and in addition have had two years' experience in a shipyard. Rate per hour $1.25 during the first six months' service in this class and to increase 5c. per hour at the end of each six months' period to a maximum of $1.50 per hour.

"*Draftsman, Grade A*—Man laying out and developing work completely from specification. Must have had two years' experience as draftsman in Grade B, or five years' drafting or equivalent experience outside of a shipyard, or be a graduate of a technical school in the course in engineering or architecture, and, in addition, have had one year's experience in a shipyard. Rate per hour $1 during the first six months' service in this grade, and to increase 5c. per hour at the end of each six months' period to a maximum of $1.20 per hour.

"*Draftsman, Grade B*—Man designing details. Must have served one year as draftsman in Grade C, or be a graduate of a technical school in the course of engineering or architecture, with some shipyard experience, or have had four years' drafting or equivalent experience outside of a shipyard. Rate per hour $0.75 during the first six months' service in this grade, and to increase 5c. per hour at the end of each six months' period to a maximum of $0.90 per hour.

"*Draftsman, Grade C*—Man handling details under supervision. Must have had two years' experience in a shipyard, or three years' drafting or equivalent experience outside of a shipyard, or be a graduate of a technical school in the course in engineering or architecture. Rate $0.65 per hour.

"*First-Class Copyist*—Man who alters tracing to agree with work or sketches of work, or man starting to do detail work. Must have had six months' experience in a shipyard, or in a drafting room, or in a technical school. Rate per hour $0.50 during the first six months' service in this grade, and to increase 5c. per hour at the end of each six months' period to a maximum of $0.60.

"*Second-Class Copyist*—Man who traces from original work. Rate $0.40 per hour."

In the first paragraph of this section, you will note that "all shipyards building vessels under direct contract with the Navy Department" are directed to follow this decision.

Also, Section XXVI gives the application of this decision and is quoted below:

"This decision shall apply on the Atlantic Coast, Gulf and Great Lakes to shipbuilding and ship-repairing plants, and plants engaged in installing equipment in ships under direct contracts with the Navy Department or the Emergency Fleet Corporation, or the United States Shipping Board, to work performed by subcontractors in such plants or upon such ships being built or repaired under such contracts and to shipyard construction or extension in this district, the expense of which is borne entirely by the Navy Department or the Emergency Fleet Corporation; provided, that rates and

RATES OF PAY FOR DRAFTSMEN AND COPYISTS, AWARDED IN DECISION OF THE SHIPBUILDING LABOR ADJUSTMENT BOARD

Oct. 1, 1918

Class	Rates Per Hour	Day	Week	Month	Year
Second-class copyist	$0 40	$3 20	$17 60	$76 27	$915 20
First-class copyist	50	4 00	22 00	95 33	1,144 00
	60	4 20	26 40	114 40	1,372 80
Draftsman, Grade C	65	5 20	28 60	123 93	1,486 20
Draftsman, Grade B	75	6 00	33 00	143 00	1,716 00
	90	7 20	39 60	171 60	2,059 20
Draftsman, Grade A	1 00	8 00	44 00	190 60	2,288 00
	1 20	9 60	52 80	228 80	2,745 60
Charge man	1 25	10 00	55 00	238 33	2,860 00
	1 50	12 00	66 00	286 00	3,432 00

EXPERIENCE REQUIRED

Class	Previous Experience	Educazion
Second-class copyists,	None	No special.
First-class copyists,	6 months	or 6 months' technical.
Draftsman, Grade C,	2 to 3 years	or technical school graduate.
Draftsman, Grade B,	4 years	or technical graduate with some experience.
Draftsman, Grade A,	5 years	or technical graduate with 1 year's experience.
Charge man,	5 years	or technical graduate with 2 years' experience.
	7½ years	or technical graduate with 4½ years' experience.

working conditions in connection with such yard construction or extension for building occupations are to be the prevailing rates and working conditions in the building trades in the locality in which the shipyard is situated."

The above quotations are from the decision in Atlantic Coast, Gulf, and Great Lakes shipyards. Section XVII is identical in the decision for Pacific Coast yards.

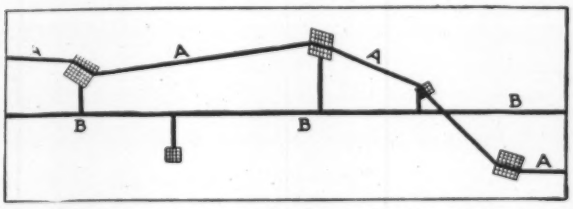
Herewith I have tabulated the rates of pay for different periods, and minimum experience required to qualify for these rates of pay.

I believe that this information should have the widest circulation among engineers, and that this can be secured through publication in *Engineering News-Record.*

Philadelphia, Penn. LLOYD W. WEED,
Concrete Ship Section, Emergency Fleet Corporation.

New Locations for Through Truck Routes

Sir—In the present literature of motor highways more attention is given to construction than to location. It seems to me that, for great highways not chiefly intended for traffic between any two cities, marked advantage would result by such location as would avoid passage of through traffic over the congested streets of the intermediate cities. Such roads would be located



THROUGH ROUTES SHOULD FOLLOW LINE B

not through cities on the route, but near them, to the advantage both of the through traffic and of the intermediate cities and towns. Such location would shorten the distance, and, by giving wider choice of location, could secure more favorable grades and curves.

The sketch illustrates the above thought. Of the two locations, A and B, for a trans-state or transcontinental highway, line B would seem to serve the purpose of freight transportation and through traffic better than line A. At the same time, the streets of the intermediate cities would not be congested with the through traffic. FRANKLIN BACHE.

Philadelphia, Penn.

Labor and Bolshevism

Sir—Your editorials on humanitarian subjects prompt me to submit the following reflections:

So much has been written regarding social conditions throughout the world today that it has seemed strange to the writer that no reference has been made to the wonderfully prophetic poem, "The Man With The Hoe." About 18 years ago Edwin Markham wrote this poem, after seeing Millet's painting of the same name. When the poem was published in the San Francisco *Examiner* of Jan. 8, 1901, there was considerable criticism of it, on the ground that it was an affront to manual labor. That this view was wrong one may easily see by even a casual reading of the poem. The great poet saw that the day would come when the relations of mankind in certain portions of the world would undergo a change. In proof of this I submit the last stanza:

> "O masters, lords and rulers in all lands,
> How will the Future reckon with this man?
> How answer his brute question in that hour
> When whirlwinds and rebellion shake the world?
> How will it be with kingdoms and with kings—
> With those who shaped him to the Thing he is—
> When this dumb Terror shall reply to God,
> After the silence of the centuries?"

We all are too prone to get our cause and effect oriented to suit our own particular viewpoint. The oft repeated words of caution regarding the necessity of guarding against Bolshevik tendencies in our country are due to lack of discrimination between cause and effect. The conception of the painting which inspired this poem was foreign. The poem does not refer to American conditions, political hodge-podgers and Socialistic teachers notwithstanding.

Albany, N. Y. E. W. WENDELL.

Waterproofing Bridge Floors With Burlap

Sir—The writer has read with much interest the very interesting article written by H. T. Welty, engineer of structures of the New York Central R.R., on the waterproofing of railway-bridge floors. In regard to the materials to be used, special emphasis has been laid, in this article, on two points which in the writer's opinion might be subject to some qualifications, and as in the present instance the qualifications are based on practical experience, they may not be uninteresting.

It is stated that the fabric used in the membrane should be thoroughly saturated, and that a cotton drilling so saturated would probably prove to be the best material to be used. It is also stated care should be taken not to overheat the compound used with the fabric.

In 1911-12 the waterproofing of about 50 bridge structures involved in the construction of the New York, Westchester & Boston R.R. was under the care of the writer. On a number of the structures the two conditions above mentioned were purposely violated, and the results have not shown that any defects were produced by this violation. In these constructions a membrane was used composed of a single ply of open-mesh untreated burlap and two coats of a special compound. It was conceded at the time that in many instances burlap which had been used with the ordinary tar and asphalt compounds had, when taken out after several years' use, appeared to be almost burned up. Chemical investigation of this phenomenon had, however, demonstrated, as far as could be judged, that this disintegration was due to the sulphur content in the coal-tar pitch, and many of the grades of asphalt used. The material used in the present instance did not contain sulphur, and such confidence was felt in the above analysis of the cause of disintegration that burlap was used without fear.

As to saturation: One of the chief needs for saturation appears to be the securing of a thorough bond between the fabric and the compound. In the present case, the compound used had such an adhesive quality that the chief difficulty in using it was to prevent it from adhering not only to the burlap but to anything

else with which it might come in contact. There would, therefore, be no difficulty as regards the bonding. Saturation of the fabric before application was thought not to be necessary with the compound used, because, if a thorough bond were obtained and the compound were thoroughly waterproof and really elastic, no water could get into the fabric, and its primary function was merely to hold the compound in place while the cover was being placed. It was also believed that with the compound used partial saturation would actually occur in the field, due to the fact that it was possible to heat this compound material to a very high temperature and apply in a very liquid form—and this leads to the second admonition in Mr. Welty's article, in regard to the question of overheating.

It was quite frankly acknowledged at the time, with the asphalt and tar compounds available, that overheating would destroy them, and this was believed to be due to the driving off by heat of the volatile solvent used in them to obtain plasticity. With the material used, however, the plasticity was not obtained by the use of a volatile solvent, and the material was heated in some instances until it was burning, and was as liquid almost as water.

Now as to results: As far as seven years' service can show, the floors have proved to be remarkably water-tight. A section of the membrane was taken out after four years' service, and has been on file in the office for two more years. The burlap has shown absolutely no evidence of any disintegration of any sort, and is in as perfect condition as on the day it was installed. The compound is bonded to it absolutely, and the burlap, if not quite saturated, has sufficient coating to prevent any possible entrance of water into it. It might be added that the compound itself has remained adhesive and elastic.

A. H. RHETT.

320 Fifth Ave., New York City.

Minute Concrete Mix Subject To Some Doubt

Sir—In *Engineering News-Record* of Nov. 28, 1918, p. 966, there was an editorial under the heading "Minute Mix Justified By Extensive Tests," in regard to which the writer, who is familiar with the report that was the basis of this editorial, desires to comment.

Professor Abrams, in the introduction to this report, rightly states that this report must be considered merely preliminary to any comprehensive investigation covering the performance of concrete mixers, but in his conclusions he makes some strikingly general deductions which are emphasized in your editorial.

From tests of a similar nature made at the Bureau of Standards and from extensive observations of field concreting operations, the writer is of the opinion that the conclusions, especially in regard to 1 min. being the most efficient period of mixing, are too general and broad in application. This the writer believes for the following reasons:

First, the results reported in Professor Abrams' paper deal only with concretes in which sand and gravel are the aggregates, and the question of the possible effect on this problem of using aggregates of different character (i. e., crushed stone) is not taken up.

The accompanying table, which includes results of some tests made at the Bureau of Standards, indicates that Professor Abrams' deduction as to the proper period for mixing is applicable to sand and gravel concrete, but not to concrete in which either crushed trap rock or crushed limestone is the coarse aggregate.

TESTS ON TIME OF MIXING CONCRETE

Mixer: Chain Belt No. 145. Each result average of [illegible] cylinder. Stored in damp [illegible]

Composition of Concrete (Parts by Volume)	Water, %	Time in Mixer	Compressive Strength Lb. per Square Inch, —Age in Weeks— 2	4	8	13	A [illegible]
1 part Portland cement, 2 parts Cow Bay sand, 4 parts crushed trap rock (¼ to 1 in.)	8.06	45 sec.	1300	1865	1965	2992	[illegible]
		2 min.	1850	2335	2710	3697	[illegible]
1 part Portland cement, 2 parts Cow Bay sand, 4 parts Cow Bay gravel (¼ to 1 in.)	6.90	45 sec.	1285	1755	1795	3060	[illegible]
		2 min.	1300	1675	1920	2832	[illegible]
1 part Portland cement, 3.15 parts Cow Bay sand, 5.42 parts crushed limestone (¼ to 1 in.)	12.2	45 sec.		840	1060	1900	[illegible]
		2 min.		1285	1785	2542	[illegible]

The consistency used may be described as a "quaking" consistency, and probably closely resembles what Professor Abrams considers the normal consistency.

Second, in this report of Professor Abrams, the facts are evident that the increase in strength due to longer mixing becomes greater as the size of the largest particles decreases. From the writer's observations, made on mixing in the field a rich concrete in which the particle of maximum size was ½ in., it is believed that the increase in strength due, say, to mixing 2 min. rather than 1 min., would be even greater in a 1:2 concrete than in the 1:5 concrete series given in this report, in which the size of the largest particle is varied.

Third, it has been observed that where an effort has been made to approximate 1-min. mixing in the field with a 1:2 mixture, with the largest particle ½ in., there is a distinct tendency for dry balls to appear in the output of the mixer. These are sometimes 3 or 4 in. in diameter, and indicate plainly that the concrete has been imperfectly mixed. In this connection it might be stated that these dry lumps might be easily broken up in molding the test pieces, and no reduction in strength result from their presence, while a quantity of such dry unmixed concrete might be a serious source of trouble in the actual work.

Finally, it is the writer's opinion that it is impossible so to coördinate the operations of filling, mixing and discharging a concrete mixer as to give the materials one full minute in the mixer and approach very near the batch-a-minute output. Where the batch-a-minute performance is accomplished, it is obtained only by greatly decreasing the actual time of mixing. From observations on the operation of some 15 different types of mixers at present on the market, it was noted that practically all of the mixers tried out required at least 30 sec. to dump a reasonable amount of their batch (in this case a 1:2 mortar).

Therefore, the writer believes that, in specifying the proper time of mixing, the mix to be used, the character of aggregate, and at least the type of mixer likely to be employed, should be considered, and a minimum time specified for all the material to be mixed in the drum, and a limit fixed on the number of batches permitted for a given period of time.

Philadelphia, Penn. HERBERT A. DAVIS,
Concrete Ship Section, Emergency Fleet Corporation

HINTS FOR THE CONTRACTOR

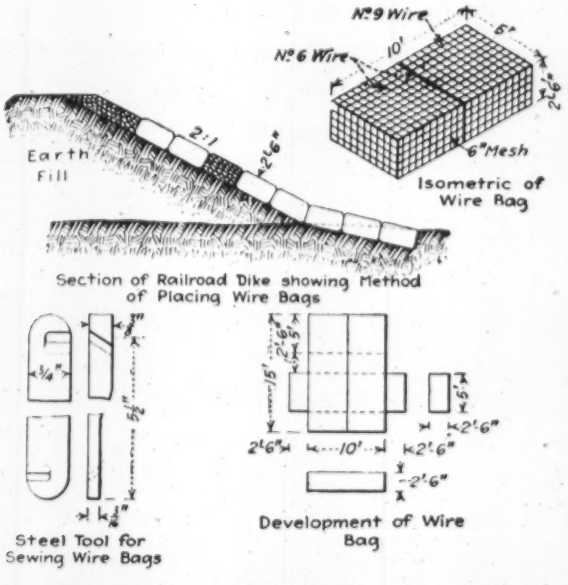
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Weaving Wire Bags To Hold Riprap on Earth Embankment

EARTH embankments at Lake McMillan, on the Carlsbad project of the United States Reclamation Service are protected by wire bags full of riprap, where the velocity of the current is higher than 5 cubic feet per second.

L. E. Foster, project manager, describes the making of the wire bags, in a recent issue of the *Reclamation Record*.

The bag material, of No. 9 galvanized wire mesh, was cut and sewed in the shop into the developed form shown in the drawing, then folded together flat, and hauled to the work. The bags were then sewed into rectangular



WIRE-MESH BAGS HOLD RIPRAP TO PREVENT SCOUR ON EARTH EMBANKMENT

form with the lid loose. The bags were set in a horizontal row in place and they were filled directly from the rock wagons.

The labor of filling the bags proved to be less than to lay riprap of the same thickness. Care was taken to have all rock next to the wire mesh of greater dimensions than 6 x 6 in. Since this is a relatively small-sized rock, much rock is available for bag work that would be otherwise considered too small for use in riprap.

After the bags were level full the top was closed down and sewed securely on the front and two sides. The bags were also tied to each other along these edges, thus forming a continuous mat.

The tool shown in the drawing was used in sewing together the bags. The ties were placed at 6-in. intervals. Each 5 x 5 x 2½-ft. bag weighed 70 lb. empty and carried 4.63 cu.yd. of riprap.

Other Articles in This Issue of Interest to Contractors:

How the New York Canal Concrete Barge is Being Built Page 268

Road Building Materials Supply Solved by System Page 289

On the basis of 259 bags the detail costs of the work are as follows:

Material required per bag:	
31 lin.ft. of 60-in. wire mesh;	
11 lin.ft. of 30-in. wire mesh;	
5 lb. No. 12 tie wire.	
Cost:	
Cost per square foot, including tie wire	$0.0229
Weight per square foot, including tie wire, pound	0.38
Weight per bag (182.5 sq.ft.), including tie wire, pounds	75.1
Cost per bag (material only)	$4.20
Detail costs:	
Material for bags	$4.20
Manufacture of bags ready for placing	.905
Placing and filling bags	1.125
Closing bags and sewing	.446
Total unit cost per bag	6.676
Cost of rock hauling for bag work per cubic yard	0.17
Cost of wire bag work per cubic yard	1.681

Swing Pipe Saves Hose Changes on Concrete Highway Work

BY H. H. EDWARDS

Highway Laboratory, University of Illinois, Urbana, Ill.

CONSIDERABLE saving of time and labor in the operation of a mixer on highway concrete construction is effected by fitting a swing joint and one or two lengths of pipe to the tee in the water line. Such an arrangement will reduce by one-third the number of times the hose has to be changed, without using an unusual length of expensive hose, which means an added saving.

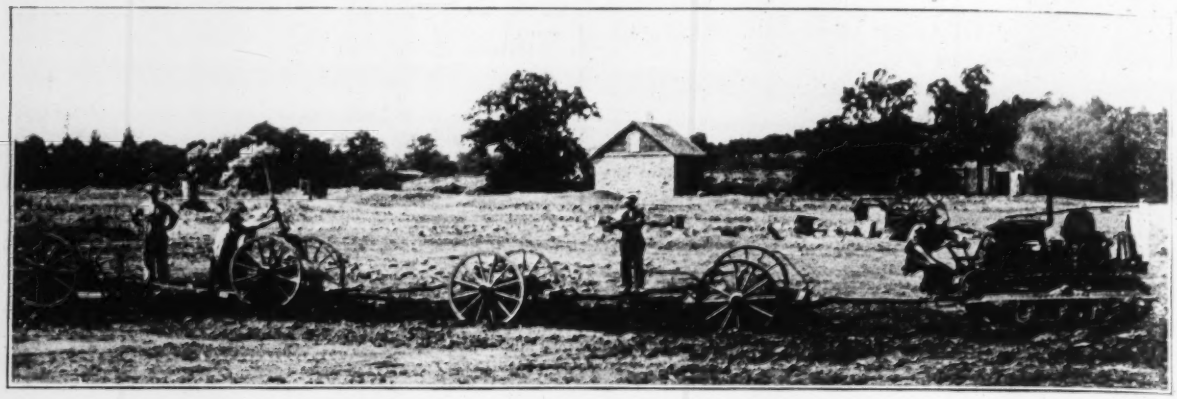
As seen by the illustration, a nipple and elbow are screwed into the tee, a couple of lengths of pipe are coupled, and the mixer hose is attached to the end. If the length of hose were such that the tees on the main line could be placed 160 ft. apart, by using the 20 ft. of iron pipe as above it would be possible to place the tees 200 ft. apart, thus reducing the number of changes. The length of pipe is first turned toward the mixer from the tee, and, as the mixer moves down the road past the tee, the pipe is flopped over and laid in the other direction.

SWING PIPE REDUCES NUMBER OF HOSE CHANGES

One Tractor Operates Six Wheeled Scrapers

SIX wheeled scrapers coupled together in train were loaded and hauled by a gasoline tractor last summer in mining molding sand near Burlington, Wis. The haul from the pit was ¼ mile to a bridge over the loading track where the scrapers dumped through a trap into cars. An evener was fitted across the back of each scraper, and the tongue of each was cut off about one-third. When coupled tongue to evener a space of 8 ft. was left between the scrapers. In operation, four to six scrapers were coupled in tandem, with the forward scraper coupled to a tractor geared to three speeds.

The train was hauled through the pit at low speed, and two men loaded the scrapers one after another. Travel to the dumping bridge was at middle speed, and return, unloaded, was at high speed. At the bridge, dumping devices automatically tripped and righted the scraper bodies. Travel to the dump was at a speed one-third faster than team haulage, and return to the pit was at twice the speed of teams. With a haul of ¼ mile and a force of four men, four to five coal cars of ordinary size, about 35 cu.yd. each, were loaded in ten hours. Previously, the same outfit of scrapers required from 15 to 18 men and three teams to accomplish the same task. The tractor scraper outfit was originated by the Walsh Sand & Gravel Co., Burlington, Wis. James Walsh devised the method of coupling the scrapers and also the automatic dumping devices.



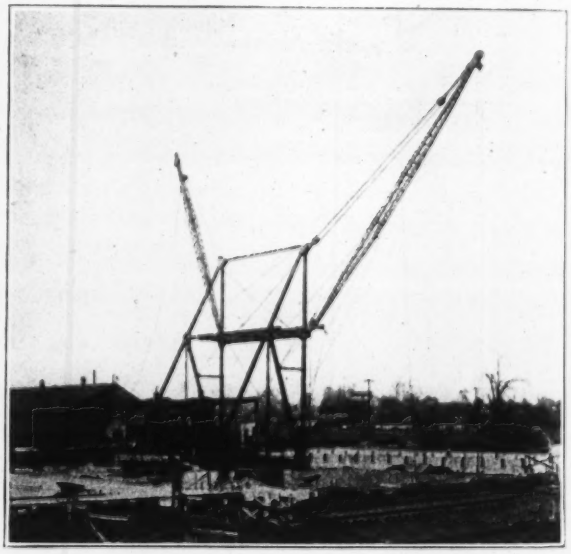
TRACTOR OPERATES TRAIN OF WHEELED SCRAPERS IN GRAVEL PIT

Special Traveler Erects Frame of Large Railway Shop

ERECTION of a steel-frame machine shop at Logansport, Ind., for the Pennsylvania Lines West of Pittsburgh, was effected by the use of the double-boom steel traveler shown in the accompanying view. The building is about 475 x 195 ft., with a 250-ton, 90-ft. overhead electric crane in the erecting bay.

The traveler has a deck about 32 x 26 ft., carrying triangular side frames which are braced together and on which are mounted two 60-ft. booms. For each boom the rated hoisting capacity is 10 tons, but 15-ton loads have been handled. Each boom is served by a 30-hp. hoisting engine and boiler, these being mounted on the working deck, 3 ft. above the rails. The track consists of a pair of 80-lb. rails spaced 25 ft. on centers, each rail being laid on ordinary railroad track ties. There are three double-flanged wheels on each side, one at the rear and two at the front, to carry the load from the mast and boom. These are of 12-in. diameter on the tread and are 4¾ in. wide over the flanges.

This work is under the direction of Robert Trimble, chief engineer of construction, Pennsylvania Lines West of Pittsburgh. The Austin Co., Cleveland, Ohio, is the contractor, with J. E. Anderson as superintendent.



STEEL TRAVELER READY TO ERECT STRUCTURAL FRAME

Dry Dock Filled by Pumping

A graving dock of moderate size is to be built by a Swedish shipbuilding company at Ljusne, North Sweden, on land above water level, and will be filled by pumping. London *Engineering* says the dock will be 328 ft. long and of such size as to accommodate a 4000-ton vessel. The boat to be docked will enter a lock and will be raised and lifted into the dock by means of water from an adjacent water-power canal. By this arrangement the dock can be filled and emptied without the use of any extra pumping plant, and at low cost.

NEWS OF THE WEEK

New York, February 6, 1919

Proposed Modifications of the Federal-Aid Road Law

Despite agitation for a more extended road-building program, it is believed by many who are in touch with the situation in Washington that the most that can be obtained from the present Congress is represented by the following clauses inserted in the Post Office Department Appropriation Bill for 1919-20 by the Senate Committee on Post Roads:

Section II of the Federal-aid road law of 1916 is to be modified so that a post road is interpreted to mean any public road which is now used, or may be made suitable, for the transportation of the United States mails, excluding roads through places with a population of 2500 or more where the houses average less than 200 ft. apart.

The amount of Federal aid in the 1916 law is to be increased by $50,000,000 for the current fiscal year, $75,000,000 for 1920, and $75,000,000 for 1921. Honorably discharged soldiers, sailors and marines are to receive preference, other conditions being equal, when labor is hired for the roads on which these additional funds are used.

War material not needed by the War Department but suitable for highway improvement, is to be transferred to the Secretary of Agriculture at the discretion of the Secretary of War, and to be then distributed among the state highway departments for use in Federal-aid road construction and national forest roads, in the same manner as Federal-aid funds are now distributed.

Appropriations of $3,000,000 annually for the fiscal years 1920, 1921 and 1922 are to be made for coöperative or independent construction of roads in the national forests.

Public Service Engineers Reinstated

On Jan. 31 the Board of Estimate of New York City reversed its action in discharging nearly 400 employees of the Public Service Commission. The commission was authorized to reëstablish the roll in force on Dec. 31, and an appropriation was made to maintain this organization for February and March (the rest of the current quarter).

All those discharged, most of whom were engineers, have been reëngaged by the commission, with the exception of some who had taken positions elsewhere. The principal effect of the board's action of Dec. 31 (noted in *Engineering News-Record* of Jan. 9,

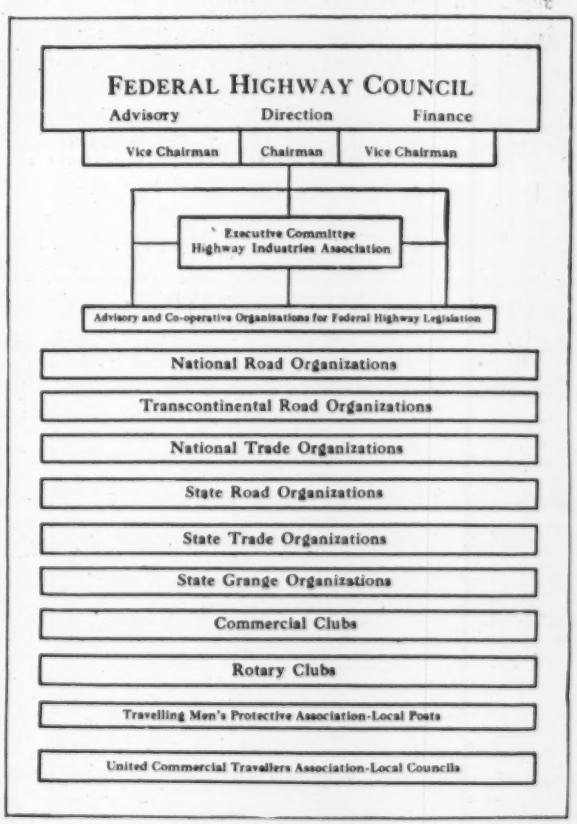
(*Concluded on page* 304)

Large Committee Will Promote Federal Highway Commission and System

Civic Organizations Throughout Country to Coöperate—Highway Industries Association Takes Leading Part

Formation of a Federal Highway Council, as outlined in the accompanying chart, is being arranged in order to promote, crystallize and mobilize sentiment throughout the country for a Federal highway commission to build a Federal highway system. The movement is an outcome of the great highway congress at Chicago last December, and the Highway Industries Association, which, with the American Association of State Highway Officials, called the joint convention, is taking a leading part in the organization of the new movement. It has been realized for some time that the present method of laying out roads under the Federal-aid, state and county plans could never produce anything but a disjointed system. The Bureau of Public Roads has not the power, under the present law, to originate work, but must wait for the state authorities to request it for aid in the road projects which they plan. Inasmuch as local interest does not require it, the states seldom connect up their systems with those of the adjoining states.

To overcome this condition, a Federal highway administration is proposed which will provide for the building of a system distinct from that of the states, while the Federal aid to the states will continue as before. Into the Federal system would be incorporated such present state and county roads as would meet the requirements of the system. Such a plan has been indorsed not only by the Chicago congress, but also by the chairmen of the 392 War Service Committees, in session in New York City, Jan. 3, as noted in *Engineering News-Record* of Jan. 9, p. 114.



PROPOSED ORGANIZATION FOR FEDERAL HIGHWAY COUNCIL

As will be seen by referring to the chart, many forms of organized activity in the country will be represented on the committee. Circular leters containing reports of the action taken by the two conventions were sent to the organizations designated and others, and more than 300 answers have been

received, giving approval and signifying a willingness to coöperate by sending delegates to assist in forming the organization.

The plan is to have one delegate from each national, state and local organization upon the main committee. These will elect the various chairmen, while the Highway Industries Association will act as the executive committee and work through the different members of its local organizations, which will in turn use their efforts to bring before the public in their particular localities the need for a national highway system.

Public Works Department Up at Washington

Congressional Committees Listen to Suggestions from Engineers for Its Formation

(*Washington Correspondence*)

Last week the long dormant subject of a Federal Department of Public Works became more or less a live issue at Washington. There is no prospect that anything definite will be done in the immediate future, particularly by the present Congress, which goes out of existence on Mar. 4 and which is far behind in its necessary appropriations and other legislative business. It is a fact, however, that the subject has been brought to the attention of at least two Congressional committees and that agitation on the part of a number of individual engineers and of the Engineering Council is in prospect.

Before the Senate Committee on Labor and Agriculture, which is holding hearings on the Kenyon bill providing for an emergency appropriation for public work (noted in *Engineering News-Record* of Jan. 30, 1919, p. 256), some engineers urged to the consideration of Congress the necessity for a department of public works. The Kenyon bill in effect provides an emergency department of public works made up of representatives of various departments, the Chief of Engineers of the United States Army, and two citizens to be appointed by the President. While the bill is supposed to be an emergency measure, it provides that the appointive members shall be designated, one to serve for two years and one for four years, and thereafter each member shall serve for four years, all of which would indicate that emergency in the mind of the author of the bill is not the same as temporary. The bill also provides that money shall be loaned to municipalities, counties and states, by the Federal Government at a rate not less than 5 per cent., to build public works, and that an officer of the Corps of Engineers, U. S. A., has to pass upon the practicability and usefulness of any state or municipal public work for which such an advance is asked. The Chief of Engineers, furthermore, is ordered to coöperate so far as is practicable with the state or local officers having in charge the planning, supervising, directing and executing of any such public work. This, it will be seen, practically puts the control of the emergency public works department in the hands of the Chief of Engineers of the Army.

The other committee before which the subject has been broached is the Senate Committee on Public Buildings and Grounds. In the course of testimony on an entirely different matter, General Marshall of the Construction Division had occasion to refer to the need for a department of public works. This seemed to interest the committee, particularly Senator Hardwick of Georgia, who was acting chairman, and the General, together with some members of his staff, and some representatives of the Engineering Council, which had later discussed the matter, were asked to appear before the committee to give their opinions of the necessity for a department of public works and possibly of a method for its operation. There has been as yet no public indication that the committee intends to bring in any particular bill for a Federal Department of Public Works, but the attitude of the senators who make up the committee and who are interested in Government construction probably more than any other senatorial committee, showed that the present is a live time for conducting among the legislators an educational campaign on the public works department idea.

Employment

For the convenience of engineers returning from military life, and others, there are listed below agencies which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau; Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service; George W. Kirchwey, state director, 16 East 42nd St., New York City.

Public Service Engineers Reinstated

(*Concluded from page* 303)

p. 112) is that the 339 discharged engineers were deprived of a month's pay, and that the rapid-transit construction work was temporarily checked and disorganized. A number of the men discharged remained at work through the month, however, and, according to officials of the commission, this proved of great assistance in carrying on the necessary office and field operations with the depleted force.

Seek Reasonable Motor Truck Requirements

Road Engineers and Manufacturers Consider Speeds, Weights and Sizes at Meeting

A spirit of coöperation marked the meeting of the National Highway Traffic Association at the Automobile Club, New York, Jan. 31, which was called to discuss the weight, size, and speed of motor trucks. In a discussion entered into by both highway engineers and representatives of truck manufacturers, there was evidenced by both sides a distinct desire to compromise on a reasonable basis. Truck limits were discussed in the light of general conditions throughout the country, and a resolution was passed to promote road building as a national undertaking.

In opening the meeting, A. H. Blanchard, president of the Highway Traffic Association, stated its purpose and announced that after hearing a few set speakers the meeting would be open for general discussion. Before opening the meeting he offered a resolution favoring a national highway commission, a national system of good roads, and greatly increased Federal aid. The resolution was unanimously carried.

George H. Pride, chairman of the Committee on Motor-Truck Regulation, the first speaker, dealt with the necessity of coöperation between the interested parties. As trucks are eminently utilitarian they must be fostered for the benefit of the country, which means the use of trucks of reasonable dimensions on adequate roads.

Since no set of figures can settle the proper thickness of road crusts, an arbitrary limit must be placed on the trucks until such time as experience supplies a working basis, according to W. G. Thompson, state highway engineer of New Jersey. Mr. Thompson maintained that at present highway design necessarily rests upon empirical rules, as there are so many unknown quantities. After pointing to the great increase in truck traffic and stating that New Jersey has as much as any state, he suggested the figures recommended by George M. Graham at the Chicago congress as a basis to start discussion. These call for a maximum truck load of 28,000 pounds. See *Engineering News-Record* of Dec. 19, 1918, p. 1109.)

Charles G. Bond, counsel for the Motor Truck Association of America, decried the tendency to include too many details in uniform traffic laws. He felt that details should be left to the local officials and that emphasis should be put on simplicity. In his opinion, the law should be limited to the regulation of dimensions, weights and speeds, leaving out such details as license fees, etc. Otherwise, there will be no possibility of getting the law adopted generally. He cited the New York State Constitution submitted a few years ago which had so many details that every one had something against it.

General conditions as they affect the problem were set forth by E. W. James, general inspector, Bureau of Public Roads. He gave statistics to show that the great porportion of roads receiving Federal aid are of types from ordinary earth up to water-bound macadam. Six-ton gross loads for bridges are about the largest that can be obtained in many states, according to Mr. James. From this he argued that before you can pass a uniform traffic law throughout the country you must secure uniform construction details. He believes that the truck of five-ton capacity is the heaviest feasible at present, and even this weight could not be borne by a large portion of the roads.

In arguing for a great campaign of education for the public, A. D. Williams, the retiring highway commissioner of West Virginia, stated that it was his belief that the United States should spend $20,000,000,000 for roads in the next few years. In answer to general discussion favoring unlimited motor-truck expansion, he said that the engineers stood ready to build roads which would bear any load, if the money is provided. Their greatest trouble is financial.

Charles M. Upham, chief engineer, Delaware Highway Commission, made a plea for definite assurance as to the maximum loads of the future, so that the engineer would have a standard to work with. Discussion brought out in this connection that the 28,000-lb. load suggested by George M. Graham is about the maximum that rubber tires will stand.

In closing the meeting, President Blanchard announced that a progress report of the Motor-Truck Regulation Committee will be made at a joint meeting with the American Road Builders' Association at its convention to be held in New York City Feb. 25-28.

Bridge Committee Discusses Road Crossings Over Large Rivers

Unification of bridge and road control under the same Governmental authority was advocated at the organizing meeting of the Division of Bridges, National Highways Association, held recently at New York. A resolution was passed expressing the opinion of the division that construction and maintenance of bridges should in general be in the hands of the same Governmental unit that builds and maintains the adjoining roads.

Active discussion developed on the subject of the present seriously inadequate provision for highway crossings over large streams, especially those forming state boundaries. Such instances were cited as the absence of all highway crossing over the Mississippi south of Memphis and over the Hudson south of Albany, and the existence of only three highway bridges across the Missouri within the State of Missouri, a length of 350 miles. The chairman pointed out the feasibility of adding a highway floor to a railway bridge at the time of its construction, and the meeting decided to promote all efforts of local authorities to obtain the construction of such joint bridges.

Recognizing the value of the work in improving bridges done by the various state highway departments, the meeting took note of the lack of similar care for problems of interstate river crossings, and resolved to coöperate in working out the problems of such crossings, when requested. The desirability of uniform requirements for bridges throughout the country was also discussed.

Another meeting of the division is to be held within 30 days. The members are: Chairman, Gustav Lindenthal, New York; Admiral H. H. Rousseau, Washington; Prof. George F. Swain, Boston; Frank C. Osborn, Cleveland; Prof. E. J. McCaustland, University of Missouri; Prof. Donald Derickson, Tulane University; Edward Duryea, San Francisco; R. D. McCarter, New York; F. E. Schmitt, New York; and Charles Evan Fowler, 25 Church St., New York City, secretary.

Illinois Engineers Will Assist In Legislation

Many General Measures for Regulation Indorsed by State Society at Bloomington Meeting

That state legislation is a means of promoting progress in engineering and technical development, is evidently the opinion of the members of the Illinois Society of Engineers, who attended the 34th annual meeting, held at Bloomington for Jan. 29-30. They indorsed measures for regulating vehicle loads and speeds, regulating housing conditions, promoting drainage and land reclamation, regulating the operation of sewage- and water-treatment plants, regulating the practice of engineering, and expediting the preparation of topographic maps of the country. Besides appointing a legislative committee, they arranged for engineering participation in the revision of the state constitution. They advocated the construction of municipal improvements and other public work as aiding in the solution of the problems of the reconstruction period, urged adequate salaries for school teachers, and also the lowering rather than the raising of railway rates on materials of construction.

Need of a state law to regulate housing conditions in order to promote health and vitality, to prevent disease and to protect the community, was presented in a paper by Charles B. Ball, of the Chicago Health Department. The housing bill now before the legislature was outlined by Senator Kessinger. As it appears that this applies to new structures, the suggestion was made that it should include the remedy or removal of existing unsanitary conditions. The engineer's part in the after-the-war reconstruction problems was reviewed by Prof. F. H. Newell, of the University of Illinois, while W. D. Gerber, of Chicago, reviewed the possibilities of engineering coöperation.

Prevailing unsanitary conditions of sewage-treatment plants was shown in a paper by M. C. Sjoblom, assistant engineer of the state Board of Health. These are due partly to ignorance and lack of understanding, but largely to neglect, plain and simple. As a remedy, Mr. Matte, chief engineer, presented a draft of a law giving to the board power to compel the abatement of nuisances and dangerous conditions, and also power to compel the employment of competent operators at both water- and sewage-treatment plants. The city water-supply system of Bloomington was described by C. D. Williams, superintendent, and a visit was paid to the pumping station, where a new concrete-lined well is being sunk.

Flexible paving for country roads, in the form of brick on gravel, macadam or lean concrete, was advocated by G. H. Reiter, of the Illinois Paving-Brick Bureau. A talk by Clifford Older, state highway engineer, on the program for road work under the Illinois $60,000,000 bond issue, produced a rapid-fire attack of questions concerning what work is to be done, and where and how.

Regulation of wheel loads and speeds on country highways was suggested in a report by J. G. Gabelman, of Chicago, as follows: Three-ton vehicles with pneumatic tires, 25 miles per hour; three to six tons, 20 and 15 miles per hour with pneumatic and solid tires; six to twelve tons, 16 and 12 miles per hour; 12 tons to maximum load, nine miles per hour; maximum wheel load to be five tons, with not more than 800 lb. per inch of tire in contact with the road; all steel-tired vehicles to be limited to six miles per hour. Formulas for regulating speeds of trucks were suggested by H. J. Fixmer, of Chicago, who also showed a new form of parabolic cross-section for streets.

Inland navigation as a possible accessory to river improvements was suggested by Prof. F. H. Newell in a paper on the water resources of Illinois, but he pointed out that the unknown factor is the economic feasibility; that is, whether the waterways would be used to such an extent or in such a way as to justify their cost.

Officers for 1919 were elected as follows: President, J. W. Dappert, drainage engineer; vice-president, F. W. DeWolf, Illinois Geological Survey; secretary, E. E. R. Tratman, Wheaton, Ill. The next meeting is to be held at the University of Illinois, Urbana, Ill.

Bowles To Leave Fleet Corporation

Announcement of the resignation of Francis T. Bowles from the position of assistant general manager of the Emergency Fleet Corporation was made by the Shipping Board Feb. 3. The resignation, tendered Jan. 25, is to take effect Mar. 15.

Proposed Raise of Rates Threatens Construction

Chicago Meeting Protests Against Increase on Sand, Gravel, Crushed Stone, and Slag

Road building will be seriously curtailed, and general construction will be retarded, if the increase in freight rates proposed by the Railroad Administration on sand, gravel, crushed stone and slag are put into effect—this was the opinion of state highway officials, producers and industrial associations voiced at a hearing held in Chicago Jan. 30, before the Central District Freight Traffic Committee. About 400 representatives of the industries affected by the proposed rate action attended the hearing.

The increase proposed is on a mileage scale, with excess for two-line hauls. The territory affected is roughly that south of the Great Lakes and north of the Ohio River and extending east from the Illinois-Indiana state line to include the western part of Pennsylvania.

Calls Proposed Rate Absurd

According to H. C. Barlow, who represesented the Chicago Association of Commerce, with the present Federal direction of railways there is logically no such thing as a two-line haul, and the increased rate proposed over single-line haul is an absurdity. He said that present rates are excessive and unjust; they should be reduced and not increased. Other speakers condemned the mileage scale as a basis for fixing rates. Producers had established their plants and built up their markets on the old rate-making basis, and the change to a mileage scale would disorganize everything accomplished. Figures were presented by large producers showing that the new scale would increase the cost of shipments to their regular markets from 10 to 150 per cent. In some instances, it was asserted, the increase would completely exclude the producer from his best markets and might even force him to discontinue business.

Commissioner S. E. Bradt said that Illinois planned to spend $60,000,000 on about 4800 miles of hard roads, and if the increase under discussion went through, Governor Lowden would hesitate a long time before authorizing construction. To ship a ton from Janesville to Park Ridge, a distance of 98 miles, the price was 30c. until last June, when it was raised to 50c. and now it is proposed to make it 95c. Mr. Bradt continued:

"You can figure out how much that means in road construction when you estimate that 6000 tons must be used to each mile. With the increase in rates last June the cost of the Illinois road program was raised from $60,000,000 to $64,000,000. This proposed raise adds at least $4,000,000 more.

"Take a ton carried from Joliet to Springfield, 148 miles. The cost was 53c. until June, then 70c., and now it is proposed to make it $1.20. Another illustration is from Racine to Evanston, 52 miles. The increase was from 40c. to 60c. last June, and the proposal is for 85 cents."

The people of Michigan, according to J. H. Bateman, assistant commissioner, will be asked to vote at the spring elections on a $50,000,000 bond issue for good roads. It is planned during 1919 to spend $6,000,000. On the basis of the new rates, freight on a mile of 16-ft. gravel road will amount to $4000 and on a mile of 18 ft. concrete road it will amount to $5200. Quoting the specific example of the Detroit-Monroe road built last year, Mr. Bateman said: "The freight on the sand and gravel for this job cost $2400 a mile before June, 1918, when the cost was increased to $3200, and now it is proposed to make it $5200." If these higher rates were put in force it would he said, gravely, affect the disposition of the people of Michigan to enter on a broad policy of road improvement.

Resolutions of protest were formally presented by delegates from the legislatures of Ohio, Indiana and Michigan. The Ohio resolution, whch is typical of the others, respectfully but most urgently requests the President of the United States, Congress and the Railroad Administration to take such action as will immediately and effectively prevent an upward revision in the freight rates upon materials entering into the construction of public works.

"This proposition will throw a wet blanket over construction of public works," said John M. Glenn of the Illinois Manufacturers' Association. "Instead of encouraging activity, it will discourage it. The proposal is a serious error."

Other speakers were Dale F. Stansbury, assistant attorney general of Indiana; O. P. Gothlin, of the Indiana Public Service Commission, and B. F. Affleck, representing the National Federation of Construction Industries.

Michigan Engineers Suggest State Board of Public Works

Establishment of a state board of public works, affiliation of technical societies, and the passage of an engineers' licensing law, were all indorsed by the Michigan Engineering Society at its fortieth annual meeting, held in Flint, Jan. 21-23. About 120 members and visitors were registered. In connection with the encouragement of drainage projects a central authority was suggested. The suggestion developed into the idea of state supervision and assistance of public works in general. A resolution was adopted for the appointment of a committee to consider whether such a plan is advisable, and how it can be carried into effect.

C. E. Drayer, secretary of the American Association of Engineers, discussed the advisability of close coöperation of engineers and engineering societies. This led to a general discussion, which ended in the appointment of a committee to consider the coöperation or affiliation of all technical societies in Michigan.

A licensing law for civil engineers was submitted by a committee and approved, with some minor changes. The committee was then directed to have the bill presented to the legislature. The suggestion was made that the bill ought to apply to engineers in general, but the majority opposed it.

Prof. H. H. Atwell suggested changes in the present cumbersome drainage laws, including means for making the credit of the state available for large projects so that the cost could be spread over several years. He estimated that Michigan has 4,000,000 acres of land awaiting drainage. Reconstruction of small water-power plants was discussed by H. K. Holland. He referred especially to plants of 8- to 20-ft. head and 100 to 500 square miles of drainage area. Municipal work by day labor was described by E. C. Shoecraft, city engineer, Flint, Mich., where all sewer, paving and sidewalk work is done by the city forces, also the cleaning of streets. He said the results have been highly satisfactory. Sanitation in a military camp was the subject of a talk by the president, Maj. E. D. Rich, late director of the school of sanitary engineering at Camp Greenleaf, and limitations in the use of chlorine for water treatment were discussed by W. C. Hirn, assistant state sanitary engineer. Duties of the county engineer as both engineer and manager were outlined by E. E. Sours, who said that at present 31 counties in Michigan, where they act more or less as county managers, are employing county engineers on salary.

Delegation to France Returns and Will Address Engineers

The delegation of American engineers which sailed from New York Dec. 5 to attend the joint engineering congress in Paris, France (see *Engineering News-Record* of Nov. 28, 1918, p. 1003) returned Jan. 31, with the exception of the chairman, Maj. J. F. Case, who went to Italy. All members of the four national societies are invited to attend a meeting in the Engineering Societies' Building, New York, Monday evening, Feb. 10, when the delegates will describe informally the work of the congress and their impressions of conditions in France.

New Bills In Congress for Federal Aid to Hudson River Tunnel

Bills have been introduced in both houses of Congress, by Senator Calder of New York and Representative Eagan of New Jersey, for Federal participation in the construction of a vehicle tunnel under the Hudson River between New York and Jersey City. The Senate bill, offered as an amendment to the Post Office appropriation bill, would direct the Secretary of Agriculture to join equally with the two

states concerned in building the tunnel as a post route; the maximum participation is fixed at $6,000,000, and the sum is to be repaid from tolls collected from the traffic through the tunnel.

Indiana Engineers Seek License Law With Architects

State Body Holds Joint Meetings with Several Local and National Sections —Watches Proposed Road Laws

Good roads construction and cost-keeping, lessons from the war, the engineer's economic welfare, and license legislation largely occupied the attention of the hundred engineers attending the thirty-ninth annual convention of the Indiana Engineering Society, held Jan. 23-25 in Indianapolis. Co-operation with local engineering organizations was well worked out. Immediately prior to the first session, a dinner meeting was held by the Scientech Club, the reorganized Indianapolis Engineers' Club. An evening session was held jointly with the American Association of Engineers, and at another meeting the local section of the American Society of Mechanical Engineers participated. The annual dinner was also held jointly with the local sections of the national societies, and the Scientech Club.

Indiana's delay in its state highway work, due to the slowness with which the courts decided its state commission to be constitutional, means that more legislation is being considered. The engineers have a legislative committee carefully watching developments to insure, if possible, a practical working plan.

M. T. Calef, highway engineer, South Bend, exhibited a careful analysis of methods of unit-cost keeping, based on all factors and spread out over a 20-year period. Prof. R. P. Wiley, in a paper on "The Rational Method of Estimating Storm Water Run-off," gave essential points in sewer design, saying that the engineer's judgment is of far more importance than generally given credit. Camp sanitation at Camp Custer, as described by S. A. Greeley, indicated that during construction the strict regulations and attention to cleanliness and personal hygiene of the men had kept the influenza from gaining any headway. Knowledge of this fact enabled the contractor to maintain a full working force and attract all the labor he needed when other contractors were unable to keep a full force.

Prof. D. D. Ewing's paper, "Electrically Driven Pumps in Small Water-Works," included concrete examples of power requirements, costs and comparisons, and gives valuable reference data.

Public-utility problems were handled in six papers, four of which were on the fuel question and war experiences.

C. E. Drayer, secretary of the American Association of Engineers, spoke at the joint meeting on "Local and National Societies Coördinated," and W. W. DeBerard was substituted for W. H. Finley, president of the Chicago & Northwestern Railway Co., who was scheduled to talk on "The Relation of the Engineer to Social and Business Problems."

H. O. Garman discussed the proposed structural engineers' and architects' bill. In effect, this will require all civil engineers to apply for license. Initial registration for a six-months' period will cost $30, but subsequent licensing by examination will cost $50, and annual renewals $10. Danger of the Illinois controversy with the architects is avoided by putting the two professions together with separate licenses for each. Penalties range from $10 to $500 in fines. Concurrent with the bill is one proposed by the county surveyors' organization for the creation of a new office, that of county engineer, with proper qualifications and with salaries, based on populations, ranging from $1800 to $4500. It is hoped to raise the standard of the county surveyor, who is now an elective statutory official without other qualifications than being a voter, by providing that the county engineer be the surveyor if the latter is qualified for the engineer's position.

The society is supporting both bills, and also instructed its legislative committee to prepare one, on civil service for municipalities, which the business men of the state Chamber of Commerce requested that the society write and present. Prof. G. A. Young was elected president, Charles Cheney, vice-president, and Charles Brossmann secretary-treasurer.

Labor Department Will Take Up Safety Code Work

The Working Conditions Service, Department of Labor, announces in connection with its plans for safety work during the coming year that the following codes, among others, will be first taken up, with the coöperation of the Bureau of Standards, Department of Commerce:

Plant arrangement, including routing of material and product, design of buildings and layout of plant; yard entrance and exit gates, roadways and walkways, railroad tracks, material piles, clearances and illuminations; fire hazards, including fire-fighting equipment, water mains and hydrants; spacing between buildings as related to occupancy, and arrangement of yard material as related to occupancy of buildings.

Building equipment, including stairs and exits, skylights, ladders, railings, and toeboards (fixed), platforms and scaffoldings (fixed), illumination and window cleaning.

Fire prevention and protection.

Elevators, including shaftways and hatchways, shaftway equipment, cables, counterweights, guide rails and bumpers, landings, landing doors and gates, cars and car construction, machines, machinery and machine rooms, car and machine safety devices, control and signals, and escalators.

Cranes and derricks, including controllers and wiring, hoist mechanism and brakes, clearances, bridge, tower and gantry cranes, locomotive cranes and derricks, and hand-power cranes.

Conveyors and conveying machinery.

Head and eye protection, including protectors for chippers, riveters, calkers, for babbitting and similar operations, sealing, grinding and similar operations, dipping and brush coatings, sandblasting, oxyacetylene welding and furnace work, and electric-arc welding and cutting.

Lumber and wood-working machinery.

Organize the National Merchant Marine Association

As a result of the American Merchant Marine conference at Washington, Jan. 22-23, a new organization was created, to be known as the National Merchant Marine Association. Its purpose will be to carry on a nation-wide propaganda in advocacy of a large American merchant marine. R. Goodwyn Rhett, former president of the Chamber of Commerce of the United States, was elected chairman, and Winthrop L. Marvin, of Boston, secretary. The governing body of the organization will consist of the officers and a council of not less than 30 members, the nucleus of which will be members of the resolutions committee which recommended the creation of the new organization.

Strong opposition was made to the report of the resolutions committee by Rear Admiral Francis T. Bowles, in charge of the Emergency Fleet Corporation at Hog Island, who contended that the interests of the various parties engaged in shipping were well represented by the American Steamship Association. He said that he was of the opinion that it was inappropriate to attempt the organization of any body representing private interests when the nation's interests were at stake.

Assurance that the United States Navy would lend every aid to the new organization was made by Commander Charles Belknap, U. S. N., who stated that the Navy should train the men and officers of the merchant marine, and that they should then be made members of the Naval Reserve. J. J. Powell, vice-president of the Bethlehem Shipbuilding Corporation, said that the cost of building American ships was a barrier against any attempt to establish a merchant marine, unless the nation assumed the undertaking; the difference between the cost of a ship in Great Britain and that of one in this country was now $100 per ton, an increase from about $25 or $35 a ton before the war. A great part of this cost, he said, was due to the increase of the cost of labor.

Among the members of the resolu-

tions committee named by Chairman Ransdell were H. A. Wheeler, president of the United States Chamber of Commerce; P. A. S. Franklin, president of the International Mercantile Marine; J. H. Pruitt, president of the Masters', Mates' and Pilots' Association; F. L. Sanford, of the Southern Pine Association, and C. E. Grunsky, of San Francisco. J. Parker Kirlin, of New York, headed the committee on organization.

A. S. Baldwin President Western Society of Engineers

A. S. Baldwin, vice president of the Illinois Central R.R., has been elected president of the Western Society of Engineers. He was born at Winchester, Va., in 1861, and began his career as a railway engineer in 1879. After 14 years of service with the Louisville & Nashville R.R., he entered the employ of the Illinois Central R.R. in 1907 as principal assistant engineer. He was made chief engineer in 1905 and in 1918 he was made vice president. He was president of the American Railway Engineering Association in 1917. As a member of the Western Society of Engineers he has taken special interest in its development and in the management of its finances.

Public Service Commission Reports on Past Year

Rapid-transit lines aggregating 63 additional track-miles were opened to traffic in New York City during 1918, according to the annual report of the Public Service Commission for the First District, New York, and it is said that the end of the current year will see placed in operation 300 of the 341 track-miles of the system remaining to be completed. It is promised that early in 1920 the entire work will be practically finished. Since Jan. 1, 1918, the Interborough and the Brooklyn Rapid Transit Companies have spent a total of $48,000,000 for construction and equipment of new lines, while the city for construction alone has spent $19,000,000, in addition to $358,600 for improvements to the first subway.

It is stated that if the Board of Estimate will coöperate in granting the necessary funds, more than $20,000,000 of the remaining $25,000,000 worth of new work yet to be done can be let before the end of the coming summer. Under outstanding contracts there is upward of $20,000,000 worth of work, contract value, yet to be done to allow $80,000,000 of new lines to be placed in operation.

The report says that the gross increase in traffic on the city transportation lines during the past year was 56,670,090, which represents per capita riding of five more rides per person than in 1917. The total amount paid to the companies in fares was $97,394,225, an increase of $2,843,309, or 3 per cent over the preceding year.

Now that the war is over, the commission believes that the grade-crossing elimination work should be actively resumed, and the legislature is asked to appropriate $250,000 as the one-quarter share of the state toward $1,000,000 which is considered necessary.

At the end of 1918 the employees of the commission, including over 400 absent on war duty, numbered 1651, as against 1855 at the close of 1917.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Feb. 17-20, New York.

The Engineers' Club of Dayton, Ohio, was addressed Jan. 21 by Worcester R. Warner, vice-president of the Warner & Swasey Co., Cleveland, who delivered an illustrated lecture on Egypt and the pyramids. The first anniversary banquet, celebrating the dedication of the new clubhouse of the club, the gift of E. A. Deeds and F. C. Kettering, will be held Feb. 4. Representatives of all the national engineering societies will be present, and the subject of the furtherance of engineering coöperation will be discussed.

The Engineers' Club of Boston, Mass., celebrated its sixth anniversary, Jan. 23, at the clubhouse. Originally the resident membership of the club was limited to 500 and the nonresident to 200. The limit is now 750 resident and 300 nonresident, and there are 603 resident members and 287 nonresident, besides the 16 life members and four Army and Navy members.

The Hamilton, Ont., Branch of the Engineering Institute of Canada held a meeting Jan. 17 at which the subject of legislation in relation to the engineering profession was discussed. It was decided that since many Governmental questions, especially those dealt with by various commissions, are essentially engineering questions, the Engineering Institute should endeavor to obtain representation on such commissions, where the presence of one or more professional engineers is appropriate.

The New York City Chapter of the American Association of Engineers will hold an open meeting of New York engineers at the Machinery Club, 30 Church St., Feb. 10. W. H. Finley, president of the American Association of Engineers, will speak on "Engineering Organization and its Relation to Public Service." The meeting will be preceded by a dinner.

The Binghamton, N. Y., Engineering Society, at the annual meeting held Jan. 28, elected the following officers: President, C. E. Anderson, vice-president Charles Van Amburgh, Burt E. Nelson and G. Fred Scharbach; secretary, D. M. Edgerton; treasurer, Frank J. Tillman; librarian, C. E. Beach.

The Houston, Tex., Engineers' Club held its regular monthly meeting Jan. 23. James Z. George, general manager of the Houston Chamber of Commerce, spoke on "The Opportunity and Responsibility of the Engineer in the Readjustment Period."

The Engineers' Club of Philadelphia, at its luncheon Feb. 11, will be addressed by Dr. William D. Lewis, principal of the William Penn High School, on "What the War Has Taught Us About the Educational Needs of Democracy."

The Manitoba Branch of the Engineering Institute of Canada, meeting at Winnipeg Jan. 20, decided that a close watch should be kept on all public works, provincial and Federal, which involve engineering problems. Among the matters discussed at the meeting were the development of national resources, highways, and drainage.

The Engineering Institute of Canada on Jan. 28 held, at the headquarters in Montreal, the preliminary session of the annual meeting.

The Utah Society of Engineers held a meeting in Salt Lake City Jan. 15, at which the initial steps were taken in a movement to consolidate all the engineering societies in Utah into one body, to be known as the Associated Engineers of Utah. The new society will comprise the Utah Society of Engineers and all other organizations of mining, civil, electrical, mechanical, and chemical engineers in the state. The recent meeting is an outcome of the one held Oct. 16, at which the proposition for the consolidation was put before the Utah Society, and a committee consisting of G. M. Bacon, H. T. Plumb, and Ernest Gayford was appointed to consider the matter. The committee has conferred with representatives of national engineering bodies and has proposed changes in the constitution of the Utah Society of Engineers which will permit that body to become the affiliating medium for all similar organizations.

The Montreal Branch of the Engineering Institute of Canada, at its regular meeting, Feb. 20, will be addressed by J. L. Busfield, whose subject will be "The Construction of the Canadian Northern Railway Tunnel, Montreal."

The Engineers' Society of Northwestern Pennsylvania, the Erie Chapter of the American Institute of Electrical Engineers, and the Erie Chapter of the American Society of Mechanical Engineers (Associated Bodies) will hold a joint meeting Feb. 11 in Erie. The lecturer of the evening will be Prof. Comfort A. Adams. His subject will be

"Arc Welding as Applied to Shipbuilding."

The **Duluth Engineers' Club**, at its meeting Jan. 27, decided to support energetically the project for a deep waterway from the Great Lakes to the Atlantic. Frank Hutchinson, Dwight E. Woodbridge and W. H. Woodbury were appointed a committee to obtain information. E. R. Lewis was elected to represent the club on the Minnesota State Joint Engineering board. Besides the regular representative, the Duluth club will be represented by two special delegates, Dwight E. Woodbridge and J. L. Pickles, at the annual meeting of the joint board, to be held at St. Paul on Feb. 12-14. A committee of the club was named to investigate prices of cement, at the suggestion of the Minneapolis Engineers' Club, that existing prices are too high under peace conditions.

The **American Water-Works Association** will hold its 39th annual convention in Buffalo, N. Y., June 10-14. The headquarters of the convention will be the Hotel Iroquois.

The **San Francisco Chapter of the American Association of Engineers** was tentatively organized Jan. 24, when 10 members of the association and six applicants met for the purpose of organizing the local chapter, discussing means for extending the influence of the organization and instituting a campaign for new members. A petition to the Board of Directors in Chicago for a charter for the chapter was drawn up and signed by all present, and a total of 20 signatures from California members was anticipated at an early date. J. H. Knowles was elected temporary chairman and A. G. Mott temporary secretary and treasurer.

The **San Francisco Section of the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers and the American Chemical Society** held a joint meeting Jan. 24 under the auspices of the electrical engineers, at the Engineers' Club. The subject of the evening was "A Symposium on Engineering Education," and 15-min. talks were made by J. W. Beckman, representing the chemical engineers; John A. Britton, the mechanical engineers; C. L. Cory, the electrical engineers; C. D. Marx, the civil engineers, and T. A. Rickard, the mining engineers. A considerable number of those present participated in the discussion. There was rather general agreement as to essentials, which were that a most important function of the college course for the engineer is to equip him so that he will be able to take a broad view of the problems he meets later. It was considered that a grounding in fundamentals is more important than endeavoring to fit a man for some specialty.

The **Tacoma Master Builders' Association**, Tacoma, Wash., recently held its annual meeting, at which the following officers were elected: S. C. Erickson, president, for another term; John Biehn, vice-president; A. L. Sutterfield, secretary; Dick Ketner, treasurer.

The Engineers' Club of Seattle has established a clearing house for obtaining positions for returned soldiers or sailors who were formerly connected with the engineering profession. E. J. Bartells, secretary, is in charge of the work.

The Associated Engineering Societies of Seattle held a joint meeting Jan. 24 at Bagley Hall, University of Washington. The features of the program were furnished by the Puget Sound section of the American Chemical Society and the Seattle Association of Members of the American Society of Civil Engineers. John L. Hall, president of the Pacific Northwest Society of Engineers, spoke on "Engineering Education."

The American Institute of Mining Engineers will hold its 119th meeting in New York during the week of Feb. 17. Members of the Canadian Mining Institute, the National Research Council and the American Institute of Electrical Engineers will join the mining engineers in their discussions.

The Topeka Engineers' Club was organized Jan. 25 at Topeka, Kan. Sixty men, residents of Topeka, were present, representing all branches of the engineering profession. The officers for the present year are: President, John Williams; secretary, Lloyd B. Smith.

PERSONAL NOTES

Readers who are returning to civil life from military, naval or other Government service are strongly urged to send in items about themselves and about their friends who are in similar situation. Items should give former position, describe character of military or other service and state the civil work to which the engineer or contractor in question is going. In the case of those with service abroad, information regarding the activities of the units to which they were assigned is especially desired.

COL. CURTISS SHOTWELL has been appointed engineer of the Third Mississippi River District, in succession to A. M. Todd.

A. D. WILLIAMS, chairman of the West Virginia State Roads Commission, has resigned in order to devote more attention to his personal business. His successor is Maj. C. P. Fourtney, as noted elsewhere.

RAYMOND BAFFREY, president of the Hennebique Construction Co., New York, and a captain of artillery in the French army, has been made a Chevalier of the Legion of Honor by the French Government. He had previously been decorated with the Croix de Guerre. Captain Baffrey left New York for France in 1914, served three years on the western front, was cited twice for valor, and was seriously wounded in Flanders in 1917. After recuperating in this country he was assigned to service with the French High Commission in New York.

MAJ. EDWARD J. LANGFORD, Engineers, U. S. A., who has been district engineer in France of the Army transportation service, with headquarters at Marseilles, has been discharged from the service and has returned to his home in Mount Vernon, N. Y. Before entering the Army he was chief engineer of the New York, Westchester & Boston Railway.

HARVEY S. OWEN, formerly engineer of construction and principal assistant engineer to the chief engineer of construction, St. Louis Board of Public Service, has joined the staff of the Lime Association, Washington, D. C., as western district engineer of the Construction Bureau, with headquarters in St. Louis.

THOMAS D. MCINERNEY, recently of the engineering staff of the ordnance department, U. S. A., at the Watertown arsenal, and the Bethlehem Shipbuilding Corporation's Fore River plant, Quincy, Mass., has opened an office for the practice of civil, mechanical and electrical engineering at 99 Chauncy St., Boston, Mass.

MAJ. C. P. FOURTNEY has been appointed chairman of the West Virginia State Roads Commission, succeeding A. D. Williams, who has resigned, as noted elsewhere. He has had extensive experience in highway construction, in this country and in the Canal Zone at Panama.

O. P. M. GOSS and R. H. RAWSON announce the establishment of the firm of Goss & Rawson, consulting engineers, with offices in the Yeon Bldg., Portland, Ore., and in the White Bldg., Seattle, Wash. Mr. Goss was formerly consulting engineer for the Association of Creosoting Companies of the Pacific Coast and for the West Coast Lumber Manufacturers' Association. During 1918 Messrs. Goss and Rawson had charge of the kiln drying of lumber at the Spruce Production cut-up plant at Vancouver, Wash. Previous to that Mr. Rawson was for six years in charge of the St. Helen's creosoting plant. The new firm will undertake investigations and reports on kiln drying plants, or the design or remodeling of such plants.

LEWIS S. SADLER of York County, Pennsylvania, has been appointed State Highway Commissioner of Pennsylvania, succeeding J. Denny O'Neil.

RONALD G. STARR, of Toronto, has been appointed engineer of the Orillia, Ont., electrical and water-works plants, in succession to the late W. K. Greenwood.

H. T. ROUTLY, head of the Routly Construction Co., Toronto, has been appointed by the Ontario Government construction engineer for the Provincial Highway, of which 100 miles will be built this season.

MAJ. JOHN F. OSBORN, 101st Engineers, formerly of the staff of Charles T. Main, Boston, has been detached from the regiment and is now working for the American Commission to Negotiate Peace, directly under Maj. Dugald C. Jackson, in estimating the damages that have been done during the war to French textile mills. His headquarters are in Paris, but he is engaged in inspection tours all along the former war front.

CAPT. C. E. HICKOK, until Jan. 1 attached to the office of the Chief of Engineers, U. S. A., Washington, D. C., has returned to his former position as city engineer of Alameda, Cal. Captain Hickok has been appointed a member of the board of engineers investigating an additional water-supply for the cities of the East Bay District, consisting of Oakland, Alameda, Berkeley and Richmond.

MAJ. E. M. GRAVES, 529th Engineers, who recently returned from France, has received his discharge from the Army and has resumed his duties as president of the Central Dredging Co., Cleveland, Ohio.

WILLIAM S. EVANS, until recently assistant to the resident engineer in charge of construction work, for the E. I. du Pont de Nemours Co. at its dye-works plant at Carney's Point, N. J., is now at Copperhill, Tenn., as engineer with the Tennessee Copper Company.

JOHN W. ALVORD, of the firm of Alvord & Burdick, Chicago, has resigned his position as chief engineer and member of the board of directors of the United States Housing Corporation of the Department of Labor at Washington, effective Feb. 1, and will return to his engineering practice in Chicago. Mr. Alvord has devoted nearly a year of service in organizing the Engineering Division of the Housing Corporation and serving on its board of directors for war emergency work.

T. C. MITCHELL, formerly junior engineer, United States Engineer Office at Great Bridge, Va., who in 1916 went to Liberia to represent the Liberian Government on the Franco-Liberian Boundary Commission, and who returned to the United States to serve in the Army during the war, will soon return again to Liberia to resume his work there. The war prevented the sending by the French Government of an engineer to coöperate with Mr. Mitchell, acting as the representative of Liberia, in delimiting the boundaries between the French possessions and the Liberian Republic.

G. H. KNUTSON, who for the past eight years has been a partner in the Fargo Engineering Co., consulting engineers, Jackson, Mich., is now associated with the Corporation Department of the Harris Trust and Savings Bank of Chicago.

CAPT. THOMAS F. BOWE, Quartermaster Corps, Construction Division, U. S. A., has been appointed Chief of Engineers, Port Utilities Office, at Newport News, Va.

MAJ. O. C. F. RANDOLPH, who received his discharge from the United States Army Engineering Corps Dec. 13, has taken charge of the sale of buildings to railways for the H. K. Ferguson Co., Cleveland. Major Randolph is a graduate of the University of Illinois, and since leaving the university has been in the bridge department of the Michigan Central R.R., and with the Timken Detroit Axle Co. as construction engineer. He was also for a time the construction superintendent for the Austin Co. He left that company to join the Army in July, 1917, as second lieutenant in the Sixteenth Railway Engineers. In France he was in charge of building work at Is-sur-Tille, some of which work was described in *Engineering News-Record* of July 4, 1918, p. 27. When the armistice was signed Major Randolph was in this country organizing a sapper regiment to return to France.

PAUL E. GREEN, district engineer of the Bureau of Industrial Housing and Transportation, has resigned from the Government service to resume his practice as a member of the firm of Marr, Green & Co., Chicago.

OBITUARY

BRIG. GEN. JOHN M. WILSON, Corps of Engineers, U. S. A., died in Washington Feb. 1. General Wilson, one of the oldest retired members of the Corps of Engineers, was chief of engineers during the Spanish War. He was born in the City of Washington in 1837, and was graduated from West Point in 1860. He served through the Civil War with conspicuous gallantry, being brevetted a colonel in 1865. From the end of the war until 1897 he was on various stations in the engineer department, mostly in Washington. President Cleveland, at the beginning of his first term, placed the then Colonel Wilson in charge of public buildings and grounds in the District of Columbia, and in 1889 he was appointed superintendent of the Military Academy, which office he held for four years. When Mr. Cleveland became president again, in 1893, Colonel Wilson was again summoned to Washington to have charge of public buildings and grounds. He was appointed Chief of Engineers Feb. 1, 1897, and held the position for four years and three months. He retired from active service in May, 1901. General Wilson was a member of the American Society of Civil Engineers and past president of the Cleveland Engineering Society.

FRED J. SAUER, assistant engineer in the office of Metcalf & Eddy, consulting engineers, Boston, Mass., died Jan. 30. He had been connected with Metcalf & Eddy for about 1½ years. Mr. Sauer was the author of the article on "Raising Two Lines of 24-inch Water Mains Seven Feet," published in *Engineering News-Record* of Jan. 30, 1919, p. 254. He was both engineer and contractor for the work described, and personally made all the plans and supervised the work, cooperating with the officials of the Metropolitan Water-Works and the Boston Water-Works.

ROBERT S. VAN RENSSELAER, borough engineer of Punxsutawney, Penn., for ten years, died there Jan. 24. Mr. Van Rensselaer was born in Burlington, N. J., Oct. 27, 1847. He was graduated from Yale University, and was one of the two original engineers who surveyed the right-of-way for the present Cresson division of the Pennsylvania R.R., from Bellwood to Punxsutawney.

JOHN ATLEE, division engineer of the Philadelphia Terminal division, Pennsylvania R.R. Co., was killed in the tunnel under Chestnut St., Philadelphia, Jan. 9. Mr. Atlee was born at Wayne, Penn., Sept. 2, 1873. He was educated by private tutors and entered the service of the Pennsylvania R.R. as rodman on construction of the Georgetown Branch, Washington, D. C., in 1893. From 1894 to 1899 he was with the engineering department of the Fairmount Park Commission of Philadelphia. During 1899 and 1900 he was in Nicaragua with the Isthmian Canal Commission; later he was instrument man in charge of construction work on the Erie R.R. Mr. Atlee reentered the service of the Pennsylvania R.R. as rodman in the maintenance-of-way department, and was promoted through the grades of assistant supervisor and supervisor to that of division engineer of the Renova Divisioin at Erie, Penn., in 1917, and then in 1918, to that of division engineer of the Philadelphia Terminal division.

Government Will Dredge Delaware River Below Philadelphia

Dredging a 35-ft. channel in the Delaware River from Philadelphia to the sea is the reported purpose of the United States Engineers. It is estimated to cost about $3,000,000, and the work will be arranged into 10 districts, so as to be divided among several contractors.

The material to be encountered is soft mud, with some sand and gravel, and will be removed on scows. It will be deposited on shore or behind bulkheads by rehandling machines or other means.

The district engineer, 815 Witherspoon Building, Philadelphia, says that he is ready to give information to contractors or others interested in the project.

National Crushed Stone Association Will Hold Convention

The first annual convention of the National Crushed Stone Association will be held at the Iroquois Hotel, Buffalo, N. Y., Feb. 11-12, 1919. The association was formed in Chicago in February, 1918.

War Department Organizes Office for Selling Surplus Materials

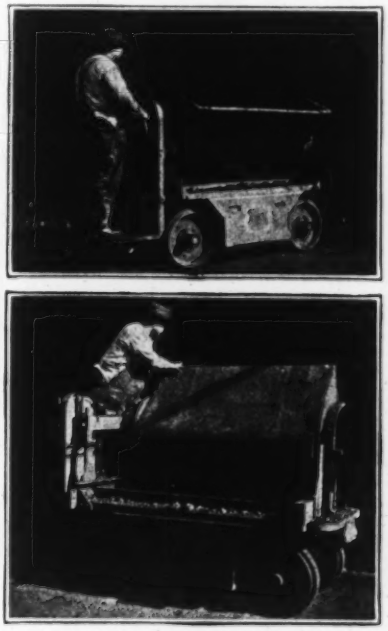
The office of the director of sales for the disposal of war materials no longer needed has been organized by the War Department. The work will be handled under the direction of C. W. Hare by a board of sales review composed of seven members. E. C. Morse is chairman of the board and each member is a division sales manager, except one, who is the legal member.

The class of supplies to be handled by each of the division heads includes machinery, construction equipment and material. Lieut. Col. A. LaMar has charge of machine tools, including all metal- and wood-working tools, railway equipment, steam shovels, locomotive cranes, gantry cranes, hand tools, forging equipment, iron and structural workers' power tools and machinery. Maj. W. W. Crunden has charge of building material, including lumber, millwork, fire protection, water-supply, fabricated steel, roofing, wall board, paints, refrigeration, hardware, brick cement, heating, machine equipment and electrical equipment. Col. Fred Glover has charge of trucks and motor equipment, including trucks, motors, motorcycles, side cars and all surplus supplies and repair parts pertaining thereto, animal- and hand-drawn vehicles.

Electric Truck Reduces Coal-Handling Costs

By the use of a storage-battery truck a Philadelphia manufacturer has reduced his coal-handling costs approximately 50 per cent. The truck is fitted with a V-dump body and hauls the coal from storage bins, where it is loaded by gravity, to the boiler house and store yard. The quick-loading facility, however, was a factor in this saving, since it was found that the truck could be loaded from the bin in 8 sec., the truck holding one ton of coal, whereas in loading the truck from the storage pile it was found that it took 5 min. to do this work by hand.

The coal-handling program commenced in the morning with a haul of 300 ft. from the storage bin to the boiler house. In two hours, however, sufficient coal was hauled to keep the boilers going all day, after which the trucks carried coal from the bins to a storage pile. It was found that in this program about 20 tons of coal were handled per hour. The haul from bins to storage piles was about 115 ft. each way. The loaded truck made the trip from bins to storage pile in 45 sec., the return trip having been made in 35 sec. The load was discharged in 10 sec. By this method the company was able to release railroad cars quickly and reduce demurrage charges. The receiving bins were emptied as fast as possible, so that unloading from the railroad cars could be started as soon as the cars were placed.



HANDLING COAL WITH ELECTRIC TRUCK

The truck is manufactured by the Lakewood Engineering Co., of Cleveland, Ohio.

England To Investigate South American Machinery Market

The Department of Overseas Trade of England and the British Engineers' Association will shortly dispatch a joint investigating committee to Brazil. The object of the investigation will be to ascertain the conditions and the prospects for the sale of British engineering products in Brazil. The cost of investigation will be defrayed in equal shares by the association and the Government, and the subjects to be covered include: Local importers, shipping methods, Brazilian law, statistics and England's chief competitors. The investigation will also include the following industries, so far as they are likely to provide openings for engineering plants and machinery: Shipping and shipbuilding; harbor and dock development; hydro-electrical possibilities, and the development of public utilities.

Business Notes

W. H. Kinsey, for the past 20 years selling water-works supplies, has been appointed New England representative, with offices at 201 Devonshire St., Boston, Mass., for the Warren Foundry & Machine Co., of New York, manufacturer of cast-iron pipe.

A. W. Greetham, manager of excavator sales of the Pawling & Harnischfeger Co., has resigned to accept a position with the T. L. Smith Co. as assistant sales manager. Mr. Greetham has been interested in the promotion of excavating and contractors' machinery for 10 years.

Bery G. Danley, formerly manager of the Haughson-Freenaughty Co., Spokane, Wash., has entered the general road-contracting business, with headquarters in Spokane.

The Blaw-Knox Co., Pittsburgh, Penn., announces that it will reopen its San Francisco office, at No. 528 Second St., in charge of Ensign Irving Burrows, recently released from the service of the Government.

Trade Publications

"Ladew Leather Belting" is the title of a 6 x 9-in., 108-p. catalogue issued by the Edw. R. Ladew Co., Inc., Glen Cove, N. Y. It illustrates and describes the manufacture of the company's leather belting, and also gives diagrams and other data regarding the use of belts.

Roadbuilding with Novaculite, a species of gravel, is the subject of a 23-p. pamphlet, 7½ x 8½ in., issued by the Egyptian Gravel Co., Railway Exchange Building, St. Louis, Mo.

The Economy Drawing Table and Manufacturing Co., of Adrian, Mich., has issued catalogue N A, 7 in. x 10 in., a 32-p. pamphlet illustrating and describing its drawing tables, sectional filing cases and other drafting-room equipment.

Price advances are indicated by **heavy type**; declines by *italics*.

PIG IRON—

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	*$35.85*	$37.60
Northern Basic	*31.80*	34.80
Southern Ohio No. 2	*32.80*	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	*36.15*	39.55
Southern No. 2 (Silicon 2.25 to 2.75)	*39.95*	.....
BIRMINGHAM		
No. 2 Foundry	*31.00*	34.00
PHILADELPHIA		
Eastern Pa. 2X	*36.15**	39.15*
Virginia No. 2	*38.10†*	40.50†
Basic	*33.90**	36.90*
Grey Forge	*33.90**	36.90*
Bessemer	.....	39.10*
CHICAGO		
No. 2 Foundry Local	*31.00*	34.50
No. 2 Foundry Southern	*37.20*	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	*31.00*	35.40
Basic	*30.00*	34.40
Bessemer	*32.20*	36.60

* F.o.b. furnace. † Delivered

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh		Chicago	
	Current	One Year Ago	Current	One Year Ago
Standard bessemer rails	$55.00	$60–65	$65.00	$60–65
Standard openhearth rails	57.00	63–65	67.00	63–65
Light rails, 8 to 10 lb	3.13½	3.125*	3.13½	3.125*
Light rails, 12 to 14 lb	3.09	3.125*	3.09	3.125*
Light rails, 25 to 45 lb	3.00	3.125*	3.00	3.125*

* Per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots together with the warehouse prices at the places named:

	Pittsburgh				San Francisco
	Current	One Year Ago	Chicago	St. Louis	
Standard spikes, ⅝-in. and larger	$3.70	$3.90	$4.50	*$3.04*	$6.15
Track bolts	4.90	4.90	5.50	Premium	7.50
Standard section angle bars	.....	3.25	4.45	Premium	5.15

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

		7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	$1.48	$1.33
San Francisco	Douglas Fir—Green	1.35	.96
San Francisco	Douglas Fir—Creosoted	2.70	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.70	No. 1	$0.55
No. 2	.80	No. 2	.65
No. 3	.90	No. 3	.75
No. 4	.98		
7x9x8 white oak			1.05
7x9x8 red oak (No. 4) $0.80		No. 5	.87

Note:—Add 36c. each for treatment.

PIPE

STEEL AND IRON PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Jan. 1 for steel pipe and iron pipe:

BUTT WELD

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent.
¼ to 3	54	40½	¼ to 1¼	36	20

LAP WELD

2	47	34½	1½	21	6
2½ to 6	50	37½	1½	28	14
7 to 12	47	33½	2	29	15
13 and 14	37½	...	2½ to 6	31	18
15	35	...	7 to 12	28	15

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1¼	52	39½	¼ to 1¼	36	21
2 to 3	53	40½			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45	33½	1½	22	7
2½ to 4	48	36½	1½	28	14
4½ to 6	47	35½	2	30	17
7 to 8	43	29½	2½ to 4	32	20
9 to 12	38	24½	4½ to 6	31	19
			7 to 8	23	11
			9 to 12	18	6

From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
¼ to 3 in. butt welded	*43%*	*44.9%*	*42%*
2½ to 6 in. lap welded	*38%*	*40.9%*	*38%*
	Galvanized		
	New York	Chicago	St. Louis
¼ to 3 in. butt welded	27%	29.9%	27%
2½ to 6 in. lap welded	23%	26.9%	24%

Malleable fittings, Class B and C, from New York stock sell at +15% list prices. Cast iron, standard sizes, 10% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York						
	Current	One Month Ago	One Year Ago	Chicago	St. Louis	San Francisco	Dallas
4 in	*$65.70*	$70.70	$58.35	*$64.80*	$58.00	*$80.50*	$74.00
6 in. and over	*62.70*	67.70	55.35	*61.80*	55.00	77.50	71.00

Gas pipe and 16-ft. lengths are $1 per ton extra.

CLAY DRAIN TILE—The following prices are per 1000 lin. ft.:

	New York				
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco
3	$35.00	$35.00	$22.50	$30.00	.....
4	51.00	51.00	27.00	40.00	$45.00
5	65.00	65.00	45.00	50.00	65.00
6	90.00	90.00	55.00	60.00	90.00
8	130.00	130.00	100.00	80.80	150.00

SEWER PIPE—The following prices are in cents per foot for carload lots:

	New York					
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$0.117	$0.096	.....	$0.125	$0.09	$0.138
4	.117	.096	.....	.125	.15	.138
5	.1755	.144	.....	.175	.1875	.207
6	.1755	.144	$0.16	.175	.225	.207
8	.273	.224	.22	.25	.3475	.2875
10	.4095	.336	.30	.375	.45	.4025
12	.5265	.432	.43	.475	.60	.5175
15	.702	.576	.65	.63	.9375	.78
18	.975	.80	.96	1.00	1.275	1.02
20	1.17	.96	1.14	1.20	1.71	1.20
22	1.56	1.28	1.46	1.60	.....	1.56
24	1.755	1.44	1.64	1.80	2.125	1.80
27	2.73	2.145	2.00	2.75	.....	2.70
30	3.024	2.376	2.70	3.45	.....	3.30
33	3.96	3.15	3.25	4.00	.....	4.20
36	4.51	3.5875	3.55	4.35	.....	4.80

	3	5	8	12	24	36
Boston	$0.12	$0.18	$0.28	$0.54	$1.80	$5.53½
St. Paul	.12	.18	.25	.45	2.00	4.75
Seattle	.15	.....	.33½	.64	2.00	.....
Kansas City	.12	.18	.25	.50	1.80	4.60
Los Angeles	.06½	.13½	.24½	.44	1.50	.....
New Orleans	.10½	.13½	.27	.459	1.75½	.....
Cincinnati	.108	.162	.252	.486	1.66½	3.99½

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8000 gal. minimum f.o.b. place named:

	Current	One Month Ago
New York, 45–65% asphalt	$0.07½	.....
New York, liquid asphalt	.08	.....
New York, binder	.08	.....
New York, flux	.07½	.....
St. Louis, 35% asphalt	.09	$0.09
Chicago, 15–20% asphalt	.10	.10
Chicago, 100% dust layer	.11	.11
Dallas, 40–50% asphalt	.09	.09
Dallas, 60–70% asphalt	.10	.10
Dallas, 75–90% asphalt	.11	.11
San Francisco, 75–95% asphalt, per bbl	*2.10*	2.15

ASPHALTUM—Price per ton in packages and bulk in carload lots:

	Brand	Package	Bulk
New York	Texaco	$35.00	$30.00
Chicago	Mexican	35.50	33.50
San Francisco	California	17.00	13.75
Dallas	Texaco and Mexican	32.00	30.00
Seattle	D grade	23.10	.....
Denver	Trinidad	59.00	.....
Denver	California	39.00	.....
Boston		35.50	.....
St. Louis	Stanolind	30.90	22.90
New Orleans	Mexican	26.20	20.00

PAVING STONE—

New York	Manhattan	$2.80 sq.yd.
	Other boroughs	2.80 sq.yd.
New York	5-in. granite	2.80 sq.yd.
Chicago	About 4x8x4 dressed	2.70 sq.yd.
	About 4x8x4 common	2.35 sq.yd.
San Francisco	Basalt block 4x7x8	57.75 per M
Kansas City	Limestone	2.90 sq.yd.
Boston	5-in. granite	98.00 per M
St. Paul	Sandstone	1.75 sq.yd.

FLAGGING—

New York	Bronx	$0.20 sq.ft.
	Manhattan	.21 sq.ft.
	Queens, 5 ft. square	.20 sq.ft.
	5x20-in. cross-walk	.70 lin.ft.
Chicago	18 in. wide	.80 lin.ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3½	16	$3.25
New York	4	16	3.50
Chicago	4	16	3.10
Chicago	3½	16	2.95
Chicago	City specifications		3.10
St. Louis	3½	16	2.45
St. Louis	4	16	2.60
St. Louis, Minneapolis spec	3½	..	2.40
St. Louis, Minneapolis spec	4	..	2.55
Kansas City	4	16	3.00
St. Paul	3½	Minneapolis specifications	2.50
Dallas	3½	18	3.17
Dallas	4	18	3.56

CURBING—Prices per linear foot are as follows:

New York	5 x 16	$0.45
	5 x 20	.55
Chicago	6 x 18	.95
St. Louis	5 x 16 square edge	.92
St. Louis	5 x 16 bull nose	.97
San Francisco	5 x 16	.65
	5 x 20	.80
Dallas	6 x 20	.45